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POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN. PROCEEDINGS OF CONFERENCE, THIRD SESSION, HELD AT CHICAGO, ILLINOIS ON SEPTEMBER 28-OCTOBER 2, 1970. VOLUME 5

Federal Water Quality Administration
Washington, D. C.

2 October 1970

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PROCEEDINGS

THIRD SESSION
RECONVENED IN
WORKSHOP SESSIONS
September 28, 29, 30,
October 1, 2, 1970.
Chicago, Illinois

Vol. 5,

CONFERENCE

Pollution of Lake Michigan and Its Tributary Basin

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U.S. DEPARTMENT OF THE INTERIOR . . . FEDERAL WATER QUALITY ADMINISTRATION

WORKSHOP SESSION FOR THE THIRD SESSION OF THE CONFERENCE IN THE MATTER OF POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN IN THE STATES OF WISCONSIN, ILLINOIS, INDIANA, AND MICHIGAN ---- VOLUME V

Bal Tabarin Room
Sherman House
Chicago, Illinois
October 2, 1970

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- - -

PRESIDING:

MURRAY STEIN, Assistant Commissioner for Enforcement and Standards Compliance, Federal Water Quality Administration, U.S. Department of the Interior, Washington, D.C.

- - -

CONFEREES:

CLARENCE W. KLASSEN, Director, Illinois Environmental Protection Agency, Springfield, Illinois.

PERRY E. MILLER, Assistant Director, Stream Pollution Control Board, Indiana State Board of Health, Indianapolis, Indiana.

- - -

ALTERNATE CONFEREES:

DAVID P. CURRIE, Chairman, Illinois Pollution Control Board, Chicago, Illinois.

ALTERNATE CONFEREES, Continued:

JACOB D. DUMELLE, Member, Illinois Pollution Control Board, Chicago, Illinois.

CARLOS FETTEROLF, Supervisor, Water Quality Standards Appraisal, Michigan Water Resources Commission, Lansing, Michigan.

DONALD J. MACKIE, Assistant Secretary, Division of Environmental Protection, Wisconsin Department of Natural Resources, Madison, Wisconsin.

R. J. SCHNEIDER, Deputy Regional Director, Federal Water Quality Administration, U.S. Department of Interior, Chicago, Illinois.

ROBERT P. HARTLEY, Director, Office of Enforcement and Cooperative Programs, Federal Water Quality Administration, U.S. Department of Interior, Chicago, Illinois.

- - -

PARTICIPANTS:

Thomas E. Dustin, Executive Secretary, Indiana Division, Izaak Walton League of America, Fort Wayne, Indiana.

A. Joseph Dowd, Assistant General Counsel, American Electric Power Service Corporation, Two Broadway, New York, New York.

PARTICIPANTS, Continued:

O. K. Petersen, Senior Attorney, Consumers Power Company, Jackson, Michigan.

Mrs. J. F. Voita, Oak Park, Illinois.

Eileen L. Johnston, Wilmette, Illinois.

Frank Pierson, Spokesman, Campaign Against Pollution, Chicago, Illinois.

Arthur Pancoe, SAVE, Campaign Against Pollution, Glencoe, Illinois.

Mrs. Lee Botts, Open Lands Project, Chicago, Illinois.

Lowell Gomes, Senior Associate, Theodore S. Leviton & Associates, Chicago, Illinois.

Edith M. McKee, Chief Geologist, Theodore S. Leviton & Associates, Chicago, Illinois.

The Honorable Abner J. Mikva, U. S. House of Representatives, Washington, D.C.

William J. Scott, Attorney General, State of Illinois, Springfield, Illinois.

John E. Bardach, Professor of Natural Resources, University of Michigan, Ann Arbor, Michigan.

Jack Hipke, Wisconsin Power and Light Company, Madison, Wisconsin.

David D. Comey, Campaign Against Environmental Violence, Chicago, Illinois.

PARTICIPANTS, Continued:

H. R. Thoke, Wisconsin Southeast Chapter of Trout Unlimited.

The Honorable Robert E. Mann, Chairman, Lake Michigan and Adjoining Land Study Commission, Chicago, Illinois.

Joseph T. Sobota, M.D., President, TEMP, Kalamazoo, Michigan.

William S. Singer, Alderman, 43rd Ward, Chicago, Illinois.

The Honorable Philip A. Hart, U. S. Senate, Washington, D.C.

Ted F. Miller, Chairman, Elk River Drainage Basin Council, Elk Rapids, Michigan.

Mrs. Louise Erickson, Chairman, Racine Committee for the Natural Environment, Racine, Wisconsin.

Ron McCandlis, President, Pro-Tem, Michigan Steelhead and Salmon Fishermen's Association, Kalamazoo, Michigan.

Miss Dana Schindler, Manistee County Anti-Pollution Organization, Manistee, Michigan.

Raymond F. Sturgis, Jr., Director, Illinois Department of General Services, Springfield, Illinois.

Herbert P. Read, State Director, Indiana Division, Izaak Walton League of America, Chesterton, Indiana.

PARTICIPANTS, Continued:

Mrs. Robert A. Barber, Deerfield, Illinois.

Mrs. Shirley Gruen, Wisconsin Federation of Women's Clubs, Glendale, Wisconsin.

Mrs. Mary Helen Dunlop, Evanston, Illinois.

George Brown, Committee on Lake Michigan Pollution, Wilmette, Illinois (presented by Mary Helen Dunlop).

Clyde Mathews, Community Action to Reverse Pollution, Gary, Indiana.

Mrs. Miriam G. Dahl, Izaak Walton League. Wisconsin State Division, Milwaukee, Wisconsin.

Mrs. Donald Trump, Chairman, Environmental Quality, League of Women Voters of Indiana, Valparaiso, Indiana.

Russell G. Hill, Executive Secretary, State Soil Conservation Committee, Lansing, Michigan.

John F. Wilson, Director, Wisconsin Ecological Society, Green Bay, Wisconsin.

Miss Carole Magnus, Secretary, Manistee County Anti-Pollution Organization, Manistee, Michigan.

Mrs. Edgar Wilkinson, Society Against Violation to the Environment, Highland Park, Illinois.

Mrs. Catherine T. Quigg, Barrington, Illinois.

PARTICIPANTS, Continued:

Vance Van Laanen, President, Wisconsin Resources Conservation Council, Green Bay, Wisconsin.

Ted MacDonald, West Lafayette, Indiana.

John C. Berghoff, Associate General Counsel, Swift & Company, Chicago, Illinois.

Sol Burstein, Senior Vice President, Wisconsin Electric Power Company, Milwaukee, Wisconsin.

Mary Alice McWhinnie, Professor, Department of Biological Sciences, DePaul University, Chicago, Illinois.

Ted Falls, President, Porter County Chapter, Izaak Walton League, Wheeler, Indiana.

Seymour Altman, Commissioner, Highland Park Environmental Control Commission, Chicago, Illinois.

Mrs. L. W. Bieker, Division Board, Indiana Division, American Association of University Women, Munster, Indiana.

Mrs. Robert McKimpton, Independent Citizens' Water Pollution Research, Ind., Hammond, Indiana.

Sylvia Troy, President, Save the Dunes Council, Munster, Indiana.

Andrew J. O'Conor, Attorney, of the firm of Berry and O'Conor, Ottawa, Illinois.

John D. Harper, Director, Environmental Parameters Research Organization, Chicago, Illinois.

PARTICIPANTS, Continued:

Harold B. Olin, AIA, Member, Board of Directors, Lake Michigan Region Planning Council, Chicago, Illinois.

A. J. Boehm, American Fishing Tackle Manufacturers Association, Chicago, Illinois.

Mrs. Paul Kaefer, Citizen, Northbrook, Illinois.

Mrs. Robert Herlocker, Calumet Area Branch, American Association of University Women, Munster, Indiana.

James Sloss, Glencoe, Illinois.

Michael R. Rouse, Waukegan, Illinois.

Mrs. Maynard J. Seidmon, Glencoe, Illinois.

Lucy M. Barr, Highland Park, Illinois.

Aaron S. Wolff, Chicago, Illinois.

Michael Sheldrick, McGraw-Hill Publications.

Mrs. Richards Schnadig, Action Acommittee, League of Women Voters, Glencoe, Illinois.

D. W. Mohr, P.E., Benton Harbor, Michigan.

Grace Marie Knapp, Mequon, Wisconsin.

The Honorable Gaylord Nelson, U. S. Senate, Washington, D.C.

F. Scammon Barry, Glenview, Illinois.

E. M. Davey.

Robert Dover, Wilmette, Illinois.

Bradley M. Glass, Attorney, Chicago, Illinois.

T. A. Meskim n, Senior Engineer, American Electric Power Service Corporation, New York, New York.

PARTICIPANTS, Continued:

Mrs. Maxwell McCrohon, Crete, Illinois.

Mrs. Dan Harper, Crete, Illinois.

The Honorable Robert McClory, U. S. House of Representatives, Washington, D.C.

- - -

PROCEEDINGS

- - -

MR. STEIN: Let's reconvene.

We have several telegrams here.

"We believe in the present environmental crisis. We must not court further disaster by allowing any industry to return heated water to Lake Michigan, until it is precisely determined what effects added heat will have on the multiple uses for which water is used. A 3 percent increase in cost of electrical production is negligible in solution of grave problems of water quality with which we are now faced." La Budde Memorial Chapter (Women) Izaak Walton League of America, Pearl L. Pohl, President, Milwaukee, Wisconsin.

I didn't know they had female chapters. I am a member-at-large of the Izaak Walton League. I think I am going to affiliate with one of those.

"The Milwaukee Chapter of the Izaak Walton League of America strongly recommends that the water temperature from water coolants used in nuclear powerplants discharged into Lake Michigan be the same temperature as that of the intake. Temperature extremes that vary widely from the norm as yet have not been fully investigated as to their effect. They could prove to be very detrimental to all aquatic life. Therefore, until sufficient research is available concerning the effect of the temperature variation of the Great Lakes waters, future nuclear powerplants should be required to maintain the present temperature level." Robert O. Kuehn, President, Milwaukee Chapter of the Izaak Walton League.

"I strongly support your efforts to establish strict and enforceable thermal pollution standards to protect the aquatic and shoreline ecology of Lake Michigan. We must not let Lake Michigan become another Lake Erie.

"I endorse the United States Department of Interior proposal to limit thermal discharges to a maximum of one degree Fahrenheit higher than the natural lake temperature.

"We must avoid irreparable damage to the ecology of the lake. Significantly raising water temperatures will not only kill some of the lake's fish but accelerate the growth of undesirable bacteria.

"Power companies can construct cooling towers to avert the warm-water problem. Toledo Edison Electric Company plans to build a cooling tower for its powerplant on Lake Erie. The cost of such towers is small compared with the cost to our environment if Michigan becomes a dead lake.

"I commend the pioneering efforts of citizens' groups such as yours in acting in the face of substantial opposition to protect Michigan's environmental heritage. I have asked Ralph Purdy to give serious consideration to your views." This is also from Senator Sander Levin.

Then, here is a letter saying: "I wish to urge as strongly as possible the adoption by the Four-State Conference on Lake Michigan of the strictest standard under consideration for control of thermal pollution in Lake Michigan: a maximum of 'one degree Fahrenheit rise over ambient at the point of discharge.'

"It is absolutely essential, if we are to preserve Lake Michigan, to take the long view; in this case, to take into consideration the long-range and cumulative effects of returning heated water to the lake. Let us not use Lake Michigan to death. Too often, we have said, 'We have no alternative;' or 'It's too expensive;' or 'We can take care of that problem later, when it arises;' and consequently we have found irreversible damage has been done by our lack of thoughtful care and caution -- by our negligence.

"Something can be done now to prevent thermal pollution of Lake Michigan: The conference can adopt the strictest standard proposed by the Department of the Interior. Please use your influence to that end."

Murray Stein

That is from Mary Helen Dunlop of 2246 Orrington Avenue, Evanston, Illinois.

And we do have some longer letters and statements and with the conference's approval I would like to put them in the record as if read and I would pass these to the conferees and they can read these, and without objection they will be entered into the record as if read.

(The letters above referred to follow in their entirety.)

HIGAN STATE CHAMBER of COMMERCE
215 S. Washington Ave., Lansing, Michigan 48933 • Phone 517/482-0657

Executive Offices

September 28, 1970

Mr. Murry Stein, Conference Chairman
Thermal Pollution Workshop
Sherman House
100 West Randolph Street
Chicago, Illinois

Dear Mr. Stein:

Enclosed you will find a copy of the Michigan State Chamber of Commerce's Policy on Thermal Effects which was adopted by our Board of Directors on January 21, 1970.

Please enter this into the proceedings of the Department of Interior's Thermal Pollution Workshop currently underway in Chicago.

Sincerely,

George P Graff

George P. Graff,
Manager, Natural Resources

GPG/sk

Enclosure

cc: Francis T. Mayo
Ralph Purdy

MICHIGAN STATE CHAMBER POLICY ON THERMAL EFFECTS

The Michigan State Chamber of Commerce has long recognized the need to protect and enhance the quality of the environment in the State of Michigan. Cooperative efforts of both the public and private sectors are necessary to effectively promote this objective.

The Waters of the State of Michigan are an important segment of the environment and should be so respected. The potential effects of thermal discharges to these waters are not fully understood. However, it is known that in some instances these effects are detrimental to legitimate uses, while in other instances they are beneficial.

Recognizing that there are many needs and objectives in society, and that they cannot all be satisfied in their entirety, the State Chamber strongly recommends that the Michigan Water Management Program, with particular reference to thermal effects, be guided by the following principles:

1. That no single set of regulations is adaptable to all situations.

2. That the management program provide for beneficial water uses, with joint consideration of alternative costs to society and the objective of preserving environmental quality.

3. That water quality standards regarding thermal effects adopted by the State are consistent with the water use management program which recognizes the needs of our society and further that Michigan industry will comply with all state standards.

4. That any use which has potential of causing significant environmental effects be carefully monitored to determine the extent of any effects and the possible need for corrective action.

5. That prompt corrective action be taken whenever effects detrimental to legitimate uses are detected.

6. That thermal effects research be promoted in an effort to obtain sound data from which intelligent judgments can be based regarding thermal discharges.

The State Chamber commends the responsible State agency's accomplishments in the area of water quality control and pledges its continuing support and cooperation in efforts to provide an improved environment and high quality water in the State of Michigan.

Lake Erie Cleanup Committee

Newport, Michigan

JOHN CHASCSA
President

MRS. IRENE FINCK
Secretary

C. W. (TED) HOFFMAN
Vice President

LAWRENCE LEIBOLD
Treasurer

September 28, 1970

Lake Michigan Enforcement Conference
Sherman House
100 West Randolph Street
Chicago, Illinois

Attention: Chairman, Murray Stein, Chief Enforcement Officer
Interior's Federal Water Quality Administration

Dear Mr. Stein:

It is indeed encouraging to learn that all types of Pollution are being investigated by your Committee.

We have, on many occasions, heard that one type of waste after another is responsible for the condition of our Lakes, Rivers and streams. In some instances we have condemned the use of our waters as dumping grounds or hiding places for unwanted waste sewage, refuse and hot water from large Industries. However, it took our President, Richard M. Nixon to open our eyes to the serious dangers involved in permitting Thermal Pollution to further complicate our Environmental problems. So, if Biscayne Bay can Become a living mass of Algae interspersed with dead and dying marine and bird life, this could and would create a very nauseating stench in the area, (which by the way is the location of our Southern White House, it isn't used much, but it is there.) You can imagine what could happen to Lake Michigan, Lake Erie or for that matter any of our inland Lakes. Lake Michigan is the most vulnerable though, and then Lake Erie.

Lake Michigan from Muskegon to Gary, Indiana, and then on to Chicago is (as you know) the natural pocket with no place for the water to flow. This area has for many years received all sorts of waste, it has been the cause of many illnesses, much fish and wild fowl mortality, and could become a hot bed of more of the same, if permission to use Lake Michigan were granted to cool industrial or municipal hot water.

Why must the general Public have to accept the loss of the use of a Public Lake, Stream or River, and be expected to pick up the tab for cleaning up the mess when it becomes too unbearable?

There are, as you have pointed out, many ways to cool and purify water and there are some that have not even been considered.

page 2
Mr. H. Stein
Sept. 28, 1970

Perhaps the state of Michigan's Fisheries Department are expecting to use the warmer water to escalate the growth of the Coho that is being planted by them, or perhaps this is a good way to get a ready cooked meal.

Seriously, the Lake Erie Cleanup Committee supports your stand on prohibiting the use of our Lakes as a depository of Thermal Pollution, or any other form.

Knowing the area around Ludington, I would suggest that these combined systems be used - such as an inland cooling Pond with spray and return canals for re-use in the plant or into the Lake.

Due to unforseen circumstances I am unable to attend this conference, but would like to take this opportunity to voice the opinion of the Lake Erie Cleanup Committee, and the Monroe County Rod and Gun Club, and to thank you for this presentation.

For a better Environmental tomorrow, I remain.

Sincerely,
John Chascsa
John Chascsa, President
Lake Erie Cleanup Committee, Inc.

cc: Conferees: Illinois Environmental Protection Agency,
Wisconsin Department of Natural Resources,
Indiana Stream Pollution Control Board,
Michigan Water Resources Commission

MR. STEIN: Now, I would like to, if we can, try to have the people who are making presentations here be as brief as possible. I know this is a public day; I also know that almost all of you -- if not all of you -- are here on your own time and volunteering your time for this. We have many, many speakers scheduled and I would ask you to be as brief as possible. If you have longer statements, we will be glad to put them in the record and when I ask for questions this will include the panel as well as the floor.

May we have Tom Dustin first, please?

STATEMENT OF THOMAS E. DUSTIN, EXECUTIVE SECRETARY, INDIANA DIVISION, IZAAK WALTON LEAGUE OF AMERICA, FORT WAYNE, INDIANA

MR. DUSTIN: Thank you, Mr. Chairman, and ladies and gentlemen of the Lake Michigan Enforcement Conference. My name is Thomas E. Dustin, and I appear as the executive secretary of the Indiana Division, Izaak Walton League of America. Our organization includes 5,300 members in 46 chapters in the State of Indiana, distributed from the Ohio River literally to the shores of Lake Michigan. Our interest and concern are directed to all phases of the natural environment, man's relationship to that environment, and the interdependencies of all living organisms with it.

Our history of direct interest in the Lake Michigan environmental unit needs little preamble.

We have been reading and hearing the press releases which have emanated from this conference since its convening September 28; and they are remarkably similar to those of previous sessions -- particularly those coming from industrial spokesmen. We know the Chairman of this conference has heard it all before, too. To hear the polluters tell it, you would think they were all milkmaids distributing effluents as pure as the driven snow. Yet Lake Michigan continues on its path to polluted uselessness.

But in the rhetoric, denials, assertions, and carefully couched semi-scientific testimony that have been offered, the essential questions have become obscured:

1) Are we, as a society, really serious about our intent to save and restore Lake Michigan? If we are -- and the Izaak Walton League answers with an unqualified "yes" to this question -- then it is perfectly obvious that we will not only have to halt the increased pollution of the lake, but must roll back the sources which have

come into existence through most of this century.

Second --

2) Are we all prepared to join together in a mighty and sustained program of active achievement, and to share among us the cost of doing it? Again, the Izaak Walton League's response is an unqualified "yes." Third --

3) Are we wise enough and perceptive enough to understand the highest and most productive purposes of Lake Michigan, and to grasp its significance in terms of all the values and dimensions, both tangible and intangible, that it holds for man, and for all of the other organisms which form its community? Again, we say that our species has this capacity for understanding, though because we have been lazy and have pursued more superficial goals, our general record has been one environmental atrocity after another.

We are not here to attack devils because we recognize that all men, institutions, and corporations are bound together in a common web of ideas, trade, and interchange of energies of one description or another.

But I will say that I hope the defense of thermal pollution reported in our local Fort Wayne newspapers, on the part of Indiana and Michigan Electric Company, is not a mirror image of our society's state of conscience and environmental awareness.

I want it fully understood that the Izaak Walton League supports without qualification the proposal by the Department of the Interior that thermal discharges be limited to not more than 1 degree Fahrenheit above the natural ambient temperature of Lake Michigan. This principle has been thoroughly reviewed by all of the policy-making bodies of our group, and by all of our membership. Moreover, we see the 1 degree Fahrenheit recommendation as a minimum goal to achieve; we support the effluent standards for all forms of unnatural discharges.

From all of the press reports and all of the testimony we have seen regarding the effects of thermal discharge on Lake Michigan, we observe that the utilities -- including Indiana and Michigan Electric Company and Northern Indiana Public Service Company -- have created a phalanx essentially around the person of one zoologist whom they have hired to justify the increased dishcarge of waste heat to Lake Michigan.

But even if Professor J. C. Ayers is right in some of his assumptions -- and there is persuasive testimony to indicate he doesn't know what he is talking about -- he stops far short of responding to far larger questions. Much of whatever genuine field studies he undertook were at the Charlevoix Big Rock installation of some 55 megawatts capacity -- almost irrelevant to the draconian questions we face here.

In describing the miniscule hot water plume there, he acknowledges that organisms that may be exposed to it have other environmental choices, since that plant operates in a comparative thermal vacuum, uncomplicated by other sources of heat.

Professor Ayers explains that most oxygen recharging of the lake takes place in winter, when the warmed epilimnion disappears, and lake temperature is relatively uniform. He makes no effort whatever to explain what happens when a warm surface condition is perpetuated, and when there are so many sources as to influence a significant portion of all shallow water environments.

No one, not even Professor Ayers, can estimate the effects over the next 30 years as the amount of waste heat rises from a mere 30 billion B.t.u.'s an hour to over 400 billion. But it will hardly be a biological health spa.

Few, if any, competent aquatic biologists have stood forward to endorse his whitewash of thermal pollution for his clients. And a great many of them fully recognize the detrimental effects. For the record, I have thoroughly read the Interior Department's September 1970 publication, "Physical and Ecological Effects of Waste Heat on Lake Michigan," and find it wholly consistent with every principle we support, and consistent with the concerns of qualified limnologists and other biologists whose opinions we have sought.

One such authority is Dr. John S. Bardach, of the University of Michigan, whose testimony in connection with NIPSCO's Michigan City construction application we have. If that statement has not yet been made part of the record of this conference, we request that this be done, and will provide a copy for you on request. It is at very least as competent as the views of Dr. Ayers and much more independent. (See Pp. 1737a-1737o)

But there is another essential question here. Spokesmen for the utilities have laid down a challenge to prove that thermal pollution is injurious. I would state to you that it is this very formula which has necessitated this conference today, and those before it. All of those who have preceded us as Lake Michigan polluters have made the same case, asking that positive proof of damage be made before the event.

I submit to you that this ploy has precisely the

Resume of Statement for the Record by

JOHN E. BARDACH, Ph.D

At a Public Hearing at Michigan City, Indiana
September 11, 1970
Before

COL. WILLIAM G. STEWART

District Engineer
Chicago District, Corps of Engineers
Department of the Army

In the Matter of

NORTHERN INDIANA PUBLIC SERVICE COMPANY

Application to Construct Intake and Discharge Facilities
In Lake Michigan at Michigan City, Indiana

Colonel Stewart, Ladies and Gentlemen:

My name is John S. Bardach and I reside in Ypsilanti, Michigan. By profession I am an aquatic ecologist with more than 20 years of teaching and research experience.

I am currently a full professor in the Department of Wild Life and Fisheries in the School of Natural Resources and a full professor of Zoology in the Department of Literature, Science and the Arts at the University of Michigan in Ann Arbor, Michigan. I was born on March 6, 1915 in Vienna, Austria and I became a naturalized American in 1953. I was graduated from the Real-gymnasium in Vienna, Austria in 1933. I then attended the University of Berlin, Germany, for two years and thereafter Queens University, Kingston, Ontario, where I received a Bachelor of Arts Degree in 1946. I received a Master of Science degree in 1948 and a Doctor of Philosophy degree in 1949, both from the University of Wisconsin.

My present teaching duties at the University of Michigan include a course in Functional Ichthyology concerning itself with anatomy, physiology and behavior of fishes, and the supervision of graduate students on physiology, ecology and behavior of aquatic organisms. Moreover, I am involved in teaching Natural Resources Ecology, a course dealing with man's influence on and management of his natural environment.

My research and publications over the last 20 years have dealt with the entire range of my expertise and particularly the physiology of aquatic organisms and the reactions of aquatic organisms to man-made and man-induced changes in lakes, streams and seas.

The following statements comprise my opinion based upon my 20 years of experience, teaching and research in my area of expertise.

Based upon my experience I have a scientific concern about the added heat load to the shore waters of Lake Michigan which would occur if electrical generating plants of the type of Michigan City were to discharge into the lake the waste heat in their cooling water in an unabated fashion.

My opinion that heat loading of the shore waters of Lake Michigan would contribute, in a long range fashion, to the deterioration of its ecology is predicated on two grounds:

1. Present knowledge of hydrographic and meteorological parameters is insufficient to make proper prognosis of the cumulative ecological effects of several electrical generating plants which would emit heated effluents into the lake. Only substantial further research will furnish the basis

---

Attached hereto as Exhibit A is a summary of my research experience from 1946 to the present. Attached hereto as Exhibit B is a list of my professional experience and honors. Attached hereto as Exhibit C is a list of publications which I have prepared or of which I have participated in the preparation.

I hold the following memberships in professional societies:

AAAS (1959); Corporation Member, Bermuda Biological Station for Research (1956); Int. Soc. Theor. Appl. Limnology (1960); American Institute Fish Res. Biol. (1962); American Soc. Zool. (1949); Amer. Soc. Limnology & Oceanography (1951); Ecol. Soc. Amer. (1958); Amer. Fish. Soc. (1954); Sigma Xi (1949); Fellow, International Academy of Zoology (1960); Amer. Soc. Ichth. and Herp. (1958); N. Y. Acad. Sci. (1966).

for judgment whether thermal changes will have moderate or pronounced effects and whether these will be more or less gradual. Experience with other man-induced environmental changes (deforestation and resultant stream warming, for instance) that affected complex aquatic ecological systems make one confident in predicting that there will be changes, many of them not beneficial. I agree with the statement of David Ehrenfeld in "Biological Conservation," Holt, Rinehart and Winston, Inc. 1970 that,

> "Chances in water temperature affect both the activity and energy requirements of aquatic organisms. Oxygen requirements also change. If the temperature rises, oxygen consumption increases but oxygen solubility in water declines. Many organisms have a narrow range of temperature tolerance. At some point lethal temperature is reached; this varies according to the rate of change of temperature, species of animal or plant and physiological condition of the individual. Since a rise of 10° C. is sufficient to double the rate of many chemical reactions, it can readily be understood why even a small amount of thermal pollution is sufficient to disrupt the organization of aquatic communities. Thermal pollution also damages ecosystems indirectly. Most important, it aggravates the effects of poisons and accelerates deoxygenation processes."

One electrical generating plant will have some adverse effect and several of them would exacerbate conditions in a more than additive manner, due to the prevailing hydrographic conditions set forth below.

Some scientists believe that heated water remains on the surface and quickly loses heat to the atmosphere rather than to the water. However, present knowledge of water-air heat exchange and heat exchange between water masses in the regions of Lake Michigan to be affected is incomplete as there is not available information on all possible weather conditions such as patterns along the shore under which these exchanges would take place. Nevertheless, and especially if there are a dozen electrical generating plants along the shoreline and if the currents flow along this shore as they are indicated to do, long term adverse effects of heating the shallow water are likely to occur and eutrophication is likely to be accelerated.

Some of the likely changes to be enumerated below are not solely or not even predominantly caused by temperature increases but a temperature rise contributes to them; others are directly related to temperature rises. Like many biological phenomena they proceed slowly at first, soon to increase in geometric proportion and to become ever more difficult if not impossible to reverse.

(2) It is my opinion that even the incomplete knowledge about Lake Michigan which we now possess, coupled with general experience of ecological phenomena permit certain scientific conclusions and opinions, as set forth below, and that make the occurrence of long term deleterious effects of heat loading of Lake Michigan's shore waters highly probable indeed. I am particularly concerned about the following long range effects, covering two or more decades, of heated effluents from several electrical generating plants being voided into Lake Michigan:

(a) An increase in the rate of eutrophication of the shore waters.

(b) A worsening of conditions favorable for, if not a threat to, the survival of a very valuable and unique fish fauna.

(c) A change in conditions so as to favor less desirable fish species such as carp and alewife.

Discharges from electrical generating plants will cause Lake Michigan shore waters to be threatened by increasing eutrophication. The cooling water discharges enter and are restricted to coastal waters, out to but a few miles from the shore. These lake areas also receive a substantial and increasing load of nutrients in the form of nitrogen and phosphorus compounds from domestic effluents and from agricultural runoff and, according to our present knowledge, the water in them does not mix substantially with the water in the lake at large during the fall, winter and spring; during the summer more mixing occurs but even then it is not continuous. Consequently fertilizing effects first and foremost occur in near-shore waters, proceeding faster at higher than at lower temperatures.

It is my opinion that the shore regions of Lake Michigan contain relatively discrete water masses which do not mix with the waters of Lake Michigan during the year at large. This opinion is based upon my experience as well as upon a recent report of the Federal Water Pollution Control Administration, Great Lakes Region, Chicago, Illinois, entitled "Lake Currents" (Lake Michigan Basin), November 1967.

> "Temperature records taken during the winter of 1961 through the summer of 1964 indicate that the following conditions occur ... The existence of thermoclines and thermal barriers during extended periods of the year greatly reduce mixing of the shallower shore waters and the waters of the hypolimnion with the main body of the lake. Such conditions promote the build-up of persistent pollutants discharged into isolated waters. Because of the prolonged periods during which such conditions can continue such build-ups can impair the uses of the water adjacent to the discharge points." Id. at p. 233.
>
> "Thermal barrier conditions during the fall, winter and spring limit the outward extent of effective mixing volume ... The late spring storms and lake overturn break up the zonation due to the thermal bar and create conditions for effective mixing with the lake proper. However, during the summer when the thermal bar no longer exists, similar build-up occurs. Boundary effects, friction and the Southern gyre are probably responsible for the lateral transfer of water along the shore." Id. at p. 353.
>
> "In general the shore currents move northward on both sides of the lake, except for periods during the late fall, winter and early spring.... Average current speeds on the western side of the lake range from 5 to 10 cm/sec, while those on the eastern side range from 12 to 14 cm/sec.... Inshore and offshore currents are quite separate from one another." Id. at p. 179.

Indicators of the changes generally subsumed under the term "eutrophication," and even now noticeable along certain portions of the shores of lower Lake Michigan, are the prevalence of algae, plankton and bottom organisms and eventually of fish tolerant of, by virtue of their evolution, and therefore adapted to warm oxygen-poor turbid water instead of those adapted to cool clear oxygen-rich water. The latter conditions were those of the Lake Michigan's geologic history and the organisms that evolved in the Lake, or in lakes like it, are therefore genetically fitted to them rather than to new man-induced ones. The biology of these fish and organisms do not permit rapid adaptation to man-induced changes.

Specific indicators of eutrophication are: blooms of bluegreen algae, the colonization of suitable substrates by the profusely growing green alga Cladophora the filaments which have known nuisance value. If effluents from electrical generating plants generate stationary warm water masses for variable periods of time it is likely that point heat sources will accelerate localized conditions of chemical and organic pollution and that commercially valuable cold water fishes will disappear and be replaced by carp, suckers, alewifes and the like. Each of these factors singly, but more so in aggregate, decrease the value of shore property as well as certain recreational opportunities.

The biological changes are gradual and cannot be properly ascertained by a one, two or even three year study following a local change such as a newly installed heated water discharge like Michigan City Generating Station as overall climatic fluctuations may mask their effects. However, the biological changes gain momentum once they have begun unless the conditions favoring them are reversed.

The deterioration of Lakes Erie and Ontario since the turn of the century provides reliable and relevant analogies to the danger Lake Michigan faces from heated water. The average water temperature of Lake Erie has risen by 2° F. since 1920, due to heat loading, even without massive spot heat inputs such as occur through electrical generating plants, and due to alterations in land use. Such a rise is tantamount to displacing the entire lake to a location 50 miles to the South. Small as the temperature change is, it is considered a contributory factor to the disappearance from Lake Erie of the Lake Herring, formerly the most abundant and valuable species in the Lake. It also favored the growth of undesirable algae in Lake Erie. Such changes in Lake Michigan as are presently being observed suggest that a comparable deterioration process may be already under way in Lake Michigan.

The Great Lakes, but especially Lakes Michigan, Huron and Superior are the home of a unique, commercially valuable species complex of fishes, i.e., the trout and salmon, related whitefishes and the lake trout. The numerically most abundant and commercially and recreationally most valuable among them spawn in in-shore or near-shore waters.

Experiments and observations at the Great Lakes Fishery Laboratory of the Department of Interior have shown them to be very sensitive to increases in water temperature, especially during their larval and juvenile periods. Their eggs are deposited on the bottom and their larvae must rise to the surface to gulp air for initiating the filling of their swimbladders. Without this one gulp they can never adjust their buoyancy. At that time they are but an inch or so in length and even if they sensed deleterious surface temperature, they are instinctively driven to the top where they will not be able to avoid warm water than could kill them. Such kills might be sporadic but could increase in frequency as patches of heated water multiply with several instead of one or two electrical generating plants voiding heated water. The kills might also not be noticed due to the small size and semitransparent nature of the fish larvae. Given such conditions, the effects of the kills would become apparent through a gradual irreversible reduction in the number of adult fish and eventually likely lead to the complete disappearance from Lake Michigan of a yet unpredictable number of their species.

It is ironic, in this context, that millions of dollars were and are spent to save these same species from the depradations of the sea lamprey and to rehabilitate them to their former abundance when the danger to them may now be shifted to thermal loading of the Lake from electrical generating plants. The main difference between the two dangers is that lamprey control necessitated costly research before it could be implemented while the method of heat abatement of cooling waters is well within technological research today.

The Pacific Salmon, recently introduced into Lake Michigan is in far less direct danger from thermal change than the species native to the Lake, inasmuch as the numbers of the former will be replenished by artificial propagation. Only where spawning streams or shore areas near them become heated may direct temperature effects threaten some of their numbers.

While zones of heated water near the shore may not harm the salmon directly, they adversely affect the fishes' recreational potential. State of Michigan biologists believe that warm water near the shore such as prevailed due to climatic conditions in 1968 and 1969 kept the fish away from the shore and therefore out of the reach of the sport fishermen's craft. Heat loading of shore waters could well make these conditions that are adverse to recreational salmon fishing a much more permanent occurrence.

Some salmon which have established spawning runs in Lake Michigan streams will enter the shore waters near them on an instinct driven journey to their spawning grounds. It has been the experience of Michigan fishermen that they are far less likely to strike the fisherman's lure in warm than in cold water.

Alewives and other undesirable fish species will be favored through lake temperature increases. Alewives are shore spawning warm water fishes which have entered the Great Lakes inadvertently, through a man-made channel. In Lake Michigan they live at the lower edge of their temperature range and are very vulnerable to such cooling as occurs occasionally. If warm water becomes available to them they seek it out, entering into existing heated effluents in great numbers. A warming of shore waters is likely to favor them as are large streams of warm water from electrical generating plants likely to attract them. They are, however, also delicate fish, prone to mass mortalities. Temperature conditions favoring their numbers could well be accompanied by far greater die-offs than have been experienced until now. Clean-up operations of millions of alewives are indeed costly to society. Over a twenty-year period their cost may well reach a significant portion of that involved in installing, initially, cooling devices for the effluents of electrical generating plants. If ancillary losses in the tourist industry were to be included, the total loss may well equal or exceed the costs of installing cooling devices. In 1967 such total direct and indirect losses due to alewife die-off was estimated at 50 million dollars on the State of Michigan shoreline alone.

I am aware that there well could be possible beneficial consequences of heated electrical generating plant effluents, especially in the first few years of a plant's operation, before the deleterious effects mentioned here would have time to build up. Fishing may improve in or near the effluent cones due to the attraction by the warm water of certain shore fishes such as perch, bass, pike and bluegill. These same water areas may, incidentally, also afford ice free fishing lagoons in the winter. Water might become warmer in certain places and make them more attractive for swimming, and in the same places the swimming season might be prolonged, at least before the build-up of algae detracts from water contact sports. These beneficial consequences, given continued eutrophication influences from other sources will almost certainly be replaced over the years with eutrophication, disappearance of native fishes and alewife nuisance. Any assumed beneficial effects would represent a poor interest indeed on a continuously devaluating large environmental capital. Cooling devices for the effluents snould be installed on all present and future electrical generating plants discharging heated water into Lake Michigan to prevent them from contributing to the devaluation of this capital. Later alleviation of thermal loading through subsequent modification of existing plants could well be more costly not only to the power industry, but, by virtue of the nature and time course of the changes indicated, it would also put an ever increasing economic burden on society at large.

Research Experience

Sensory physiology, especially chemical and temperature senses of fishes:

1968--: pilot study of effects of thermal pollution on behavior of bullheads.

1967-1968: Chemical senses in communication and social behavior of fishes.

1967: Electro-olfactograms of tuna (unpublished) Chemosensory orientation of tuna (unpublished)

1963-1966: Research with chemical and mechanical senses of fishes in relation to behavior.

1961-1963: Research with time-coordinated behavior and learning of fishes (see Biographical sketch and Publications)

1961: Sabbatical Leave, study of fish physiology and behavior with Prof. Sven Dijkgraff and G. P. Baerends of Universities of Utrecht and Groeningen, Holland, respectively. Holder of OEEC Senior Visiting Scientist Stipend.

1953-1957: Research on temperature and tactile senses of fishes, Research and Behavior of Reef Fishes.

1946-1953: Graduate Studies, Madison, Wisconsin, under Professor A.D. Hasler on ecology and physiology of fishes, teaching assignment at then Iowa State Teachers College and student research supervision (University of Iowa graduate students) and own research on limnology and ecology at Iowa Lakeside Laboratory.

EXHIBIT A

Professional Experience and Honors

Re-introduced instruction and research in Limnology, Iowa Lakeside Laboratory, 1950-1953.
Director, Bermuda Government Fisheries Research Program, part-time, 1954-1958.
Fisheries Advisor, Government of Cambodia, on leave of absence from University with AID, 1958-59.
Senior Visiting Fellow in Science, O.E.E.C., at University of Utrecht and Groningen, Holland, study of comparative physiology and behavior, 1961.
Behavior and ecology of reef fishes, senior investigator (NSF), 1955-57.
Bermuda government - fisheries research program, program director (government of Bermuda), 1955-56.
Temperature sense of fishes, senior investigator (Horace H. Rackham School of Graduate Studies), 1956-58.
Investigations of sensory structures in skin of fishes, senior investigator (Horace H. Rackham School of Graduate Studies), 1958-62.
Time-coordinated behavior of fishes, senior investigator (NSF) 1962-63.
Extra-enteral food uptake by fishes, senior investigator (Michigan Memorial-Phoenix Project).
Time sense of fishes, senior investigator (NSF) 1961-62.
Coloration of Reef Fishes (Horace H. Rackham School of Graduate Studies) 1965.
Skin senses of fishes, principal investigator (PHS Grant No. NB-04687-01-05) (1963-1968).
Chemical Senses of Fishes, principal investigator (NIH, INDB Grant 04687-06-09) 1968-1971.
Research and Fact finding on World Status of Aquaculture for National Council on Marine Resources and Engineering Development, 1967.
Participation National Academy of Sciences organized International workshops: Oceanography and Fisheries Manila, 1967, Food, Djakarta, 1968.
Consultant to Econ. Comm. Asia and Far East, U.N. Bangkok; also to Asst. Administrator for Far East U.S. AID/ Department of State, Washington, D.C. and short term State and Federal Assignments dealing with physiology of aquatic organisms in relation to water quality control.
Fellow American Association for the Advancement of Science (1963)
President and Co-founder: Michigan Association for Conservation Ecologists (1964)
Member Pacific Science Board, U.S. National Academy of Sciences (1967)
Distinguished Faculty Achievement Award, The University of Michigan 1967.

EXHIBIT B

BIBLIOGRAPHY - PROFESSOR JOHN E. BARDACH

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same validity as a demand that you prove a war yet unfought will kill people.

I challenge them to look for themselves at Lake Michigan and tell us that pollution does not kill.

Why should the burden of positive proof rest on our shoulders? It is because we have always carried that burden that Lake Michigan is in its deteriorating condition now.

It is time those who would use our waters for septic tanks and stewpots prove their actions will be harmless.

They cannot make that case; and it will take more than one hired biologist to make it for them.

Is it not time -- is there not already enough in our abominable environmental history on Lake Michigan -- to at last stand firm and say "enough"?

Let us turn back the destruction of Lake Michigan before the fact. Once it is a fait accompli, it becomes just another mistake of the past that we must live with indefinitely, if we will be able to live with it at all. Both the Federal and State Governments should by now have seen enough of the fait accompli here not to want any more of it.

We recognize that every special group of polluters does its own thing when appearing before these conferences. The steel mills gave you their routine, and the chemical companies, the refineries, the harbor interest, the Corps of Engineers, and now the utilities, each in turn, as their own environmentally irresponsible status quo comes under test. But just look at Lake Michigan and where it is going.

It seems evident -- and the Izaak Walton League has been a participant in all of these matters -- that unless we see and understand Lake Michigan in a larger perspective, we will be permanently committed to these cat-and-dog squabbles as each new kind of defecation in the lake comes to light. And as long as we are committed to unlimited growth, unlimited production, unlimited consumption, unlimited population, unlimited power, and unlimited profits and material things of all kind, there will be little hope that our greatest efforts can save this lake or anything else that cannot be priced in dollars.

It seems the utilities are committed to just such a course. They will come before you with the statement that power capacity must double every 10 years to meet the "demand." It is a vicious circle.

There is something fundamentally defective in our way of doing things in the environment. We have always operated our industrial systems open-endedly, scratching from the earth what we could use, and indiscriminately spewing out what was not profitable to convert. We are long past the point that this stone age attitude should have changed. But it must change, and we must all be part of that change. We will have to learn how to create closed systems, including retention and conversion of waste heat.

We recognize Lake Michigan and its general environment as a unit, not separable nor dissectable as a pie, whose parts are doled out to the most ravenous appetites. It is our position the whole of it is weakened when one part is assaulted.

It is a total resource of incalculable value to all of the people in its watershed and far beyond that. If we justify its impairment at one location, then it is difficult to defend at other places.

Above all, the Lake Michigan environmental unit should be a public trust, and no one should have the right to impair it; everyone should have the responsibility to restore and preserve it. The cost of failure to accept and act upon this principle will be infinitely greater than the alternatives; and we will be committed to an endless series of futile conferences mainly because we have not defined and made clear that the legitimate uses of Lake Michigan simply exclude using it as a dump for waste heat, chemicals, harbor dredgings, and all of the other spewtum of our society. No well-considered Lake Michigan policy could possibly include such uses.

Instead of adopting a general Lake Michigan policy, we are continuing to be confused by smokescreen rationale which create the aura of acceptability for further destruction of this lake. In recognition of this perpetual problem, the Indiana Division of the Izaak Walton League has adopted a 10-point proposed policy for Lake Michigan. We do not pretend that it is the last word or that it is ultimate in quality. But it is a start. Most important, it treats Lake Michigan as an environmental unit; and we believe the lake must eventually be seen in that light, and not as a carcass from which chunks can be torn off at will by any interest that wants a piece -- such as the utilities now propose, and the steel mills before them.

Proposed Policy Position

1) Prohibitions of any more landfills or alterations of the natural shorelines, coupled with a total evaluation of the social, economic and ecological qualities of Lake Michigan.

2) Acquisition of an environmental easement along all undeveloped portions of Lake Michigan shoreline, pending results of the total evaluation, at which time decisions should be made as to what portions of the easement should

become permanent, and what should be expanded in the public interest and for environmental protection.

3) Establishment of total effluent standards for all discharges to Lake Michigan including the 1 degree Fahrenheit above ambient proposed by the Department of the Interior.

4) A strict constructionist establishment and interpretation of a nondegradation policy for both water and air discharges in the lake context.

5) A no-discharge policy for all commercial and industrial shipping, including on-board surveillance and enforcement by trained interstate or Coast Guard agents, together with complete environmental control systems and design for all such vessels using Lake Michigan.

6) Prohibition of any dumping dredged materials from harbors, ship canals, industrial wastes or slags, and similar materials into any waters of Lake Michigan or its drainage basin.

7) Special Federal and State appropriations earmarked for sewage treatment systems in the Lake Michigan Basin, planned for maximum cost effectiveness along lines proposed in 1969 by the U. S. General Accounting Office.

8) A total prohibition of all persistent pesticides in the Lake Michigan Basin.

9) A general "inland development policy" which would prevent further visual, physical or ecological intrusion on Lake Michigan.

10) A firm policy with respect to all Lake Michigan ports which would require nonpolluting handling of all shipboard wastes and residues, and environmentally designed and operated fueling, servicing and cargo transferring procedures.

Until we are all ready to proceed with a comprehensive policy at both the Federal and four-State levels, and until we are ready to enforce it, we see little hope of saving the Lake Michigan environmental unit. As long as there are holes and vagueness in our position, they will be exploited.

On the other hand, if a policy can be firmly established, the kind of brush fire we are fighting today will be diminished if not extinguished. The utilities will, as they should, build away from these shorelines and include all environmental factors within integrated and closed systems. They are perfectly able to do this, or would be able to do it, when the answer to doing it in and on the lake is simply a flat "no."

In closing, in the record is a letter of September 16 by Senator Vance Hartke of Indiana, which was submitted in the context of the Michigan City hearing on the NIPSCO application. We wish that to become a part of the record as it is especially germane, and I will turn in to you a copy of the statement prepared by the student Alpha Chapter of the Izaak Walton League of Fort Wayne, which is the first student chapter of the Izaak Walton League. We will submit that for the record.

MR. STEIN: We will be glad to receive that information for the record.

(The documents above referred to follow in their entirety.)

WARREN G. MAGNUSON, WASH., CHAIRMAN
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DANIEL K. INOUYE, HAWAII
JOSEPH D. TYDINGS, MD.
WILLIAM B. SPONG, JR., VA.
NORRIS COTTON, N.H.
HUGH SCOTT, PA.
WINSTON L. PROUTY, VT.
JAMES B. PEARSON, KANS.
ROBERT P. GRIFFIN, MICH.
HOWARD H. BAKER, JR., TENN.
CHARLES E. GOODELL, N.Y.
MARLOW W. COOK, KY.

FREDERICK J. LORDAN, STAFF DIRECTOR

United States Senate
COMMITTEE ON COMMERCE
WASHINGTON, D.C. 20510

September 16, 1970

Colonel William Stewart
District Engineer
U. S. Army Corps of Engineers
Clark Street
Chicago, Illinois

Dear Colonel Stewart:

Indications from a great many Indiana residents, especially in the northwest region of the state, provide evidence of the interest I felt would be shown at the Michigan City hearing which I requested that you hold, regarding an application by the Northern Indiana Public Service Company to construct a flume and to discharge heated water to Lake Michigan.

In the interest of not biasing the hearing, I have withheld my views until its conclusion and now desire to have the following included in the record of the proceedings:

I oppose the granting of this permit and urge the Corps of Engineers to encourage the applicant to consider inland sites for construction of any increased generating capacity that may be needed. My opposition to granting of the permit is based upon the following:

1.) While there are conflicting views on the effect of thermal pollution, it seems clear that introduction of heat to the water of Lake Michigan can have nothing but a deteriorating effect. Studies which attempt to minimize the effect of thermal pollution appear superficial, do little to consider long-term adverse effects, and fail to take into account the proliferation of thermal sources which are already contributing to the degradation of the lake.

2.) The construction of a huge power plant and a 500-foot discharge stack immediately adjacent to the edge of Lake Michigan, as proposed, will create a major visual intrusion bordering the Indiana Dunes National Lakeshore on the west and towering over boating and recreational harbors and facilities lying immediately east of the plant site.

3.) State-of-the-art control of sulphur oxide discharges from utility plants is highly unsatisfactory, and, indeed, such controls for existing power plants along Lake Michigan seem virtually non-existent. Control of particulate emission is almost equally unsatisfactory; complaints have been lodged by many interests along the Lake Michigan shore, indicating unacceptable flyash fallout and great cost in removing it and restoring finishes to such objects as homes and pleasure boats. There is no acceptable assurance that an additional power plant at the proposed location will reduce this costly form of pollution.

4.) Construction of the plant would be accompanied by huge coal and combustion products storage areas, inevitably creating an eyesore, destroying the beauty of the shore areas and quite probably adding to existing pollution problems of both air and water, as well as increasing local noise background.

5.) Considerable erosion has taken place along the Lake Michigan shoreline, most notably in the Beverly Shores area, and this appears to be traceable to landfills at Michigan City which interfere with the normal littoral flows along the shore and to the considerable discharge of hundreds of thousands of gallons of cooling water per minute from the existing flume.

6.) In spite of plans to prevent or minimize chemical pollution aspects from power plants, nutrients and heat appear to be contributing to accelerated growth of algae and to the continued degradation of water quality which is occurring in Lake Michigan. For decades, Colonel Stewart, our society has been at Russian roulette with our water resources. Almost universally in the past, we have given ourselves the benefit of the doubt in deciding whether to use our shorelines and great bodies and streams of water as recepticles for wastes and other unwanted by-products of production processes.

The results of this policy have ruined much of our rivers and streams, has polluted our Great Lakes to a point approaching uselessness for recreation, commercial and sport fisheries, and for many other legitimate needs which are clearly in the public interest.

While we have enacted far-reaching legislation, which if fully implemented should begin to reverse the destruction of our waters, including Lake Michigan, the fact is that this body of water is now in worse condition than it was five years ago. In my opinion, this is traceable to the fact that new abatement facilities are slow in coming,

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are not planned for maximum effectiveness, and are offset by new sources of pollution, which are being permitted. This is intolerable.

Even now the areas of Lake Michigan that are still usable for millions of bathers and other water recreationists are maintained that way only through heavy use of chlorine and other disinfectants, such as are used at the Indiana Dunes State Park by the Department of Natural Resources.

It is not at all alarmist to anticipate that the next significant increase in environmental pollution could well reduce these waters below the quality of safety and aesthetic acceptability.

In the present situation I have also become aware of the distressing fact that the company has already constructed major parts of a discharge flume required by the proposed new plant. Apparently, this has been done in anticipation of routine approval of the permit application. I am sure the Corps of Engineers is sincere in its intent to give full consideration to the provisions of the National Environmental Policy Act of 1970, and is in no way a party to any pre-hearing conclusions or informal understandings.

Let me observe that throughout much of our environmental history, it has been the burden of those concerned with pollution to demonstrate conclusively that a proposed activity will be harmful to the environment. I believe this principle has outlived its usefulness, if it ever had any. It should be the burden of those interests which proposed the activity to demonstrate conclusively that no harm will result from it.

The evidence and data available with respect to the type of activity proposed by the Northern Indiana Public Company leads me to the conclusion that the company cannot make that case, and that very great damage will in fact be caused to all of the environmental qualities cited in your notice of the September 10th hearing, if this plant is permitted to be built at the proposed location.

Therefore, the permit application should be rejected, and the company should be encouraged to locate inland. Such a facility should encompass within its site: all systems needed for air pollution control;

cooling ponds or other techniques to prevent thermal pollution of external or underground waters; carefully planned fuel storage areas; and a detailed plan for non-polluting disposal of combustion residues.

Sincerely,

Vance Hartke
Vance Hartke
United States Senator

Lake Michigan Enforcement Confernece Workshop
c/o The Sherman House
100 West Randolph Street
Chicago, Illinois

Attention: Mr. Murray Stein, Chairman
(Federal Water Quality Administration)

We are an organization of college students who are formally associated with the Izzak Walton League of Americans. Some of us arranged and organized, and all of us participated in the Earth Day seminars presented at the Fort Wayne Regional Campus of Indiana-Purdue Universities last April. The seminars were conducted by various University faculty members, and by members of the Fort Wayne community, including Mayor Harold Zeis and state and federal officials. They were well-attended, from 9:00 a.m. to 10:00 p.m., by students from local high schools, and from the several colleges and universities in the city, as well as by other interested persons from the Fort Wayne area.

As you may know, regional universities such as ours, are largely attended by people who are working to pay all or most of their own way through school. Some are married, with families, some are veterans; virtually all are concerned with information and education, before demonstration.

In an effort to prevent our concern for the environment from ending with Earth Day, this group met to find ways of continuing our interest, and of taking an active part in changing unfavorable conditions. In the end, it was decided to affiliate with the Izzak Walton League (as its first campus chapter) becuase we believe our efforts can carry further through cooperation with a respected organization whose resources of various kinds far exceed those a small group can muster.

While our commitments prevent us from attending the conference, we would like our views to be known and heard.

I

We heartily commend the three Interior Department agencies for the responsible and forthright statements issued in their report "Physical and Ecological Effects of Waste Heat on Lake Michigan."

It seems unnecessary for us to point out what many at the conference have undoubtedly discussed in detail: the incalculable resource--economic, recreational, biological, climatological, aesthetic, spiritual--which lakes represent.

Many avenues of investigation suggest that there is no evidence showing the effects to be deleterious to disastrous, and extremely difficult (if not impossible) to counteract.

The conclusion is inescapable that preventive medicine is imperative, not only in terms of effectiveness, but also because corrective measures are unquestionably even more costly.

We therefore support the view that recommends no increase in temperature of the waters of Lake Micigan.

II

We also strongly support the search, by government and industry, for better ways of dealing with all industrial and metropolitan wastes, including the thermal waste discussed in the report "Feasibility of Alternative Means of Cooling for Thermal Power Plants Near Lake Michigan."

We encourage federal agencies to support actively those methods which promise the least damage, in any way, to the environment.

While it is to be anticipated that objections to such proposals will be raised on the basis of costs, let it be noted that cost considerations do not, in the end, harm a company or industry as much as they harm the consumer. It is he who ultimately pays. Ironically, this is true whether it be in terms of higher costs for services, or in terms of a devaluated earth.

We, as present and future residents of the Fort Wayne area---a community which depends primarily for power on the Indiana and Michigan Electric Company--wish the Conference to know that we are not only willing to pay more for power, but insist that we must, in order to bear our rightful share of the responsibility for preventing further deterioration of Lake Michigan

And, we strongly recommend that effective controls be instituted by industry and the government for the prevention of yet another pollutant being introduced into this lake.

III

We recognize that most of the ill effects of an industrialized society were not realized or even imagined only a few decades ago. Many practices which were acceptable in a sparsely-populated world have become intolerable in a crowded one.

We do not blame the past. It is one of the characteristics of mankind to be more gifted at hindsight than at foresight.

We do blame the present for remaining, in such large measure, insenstive or callous to the dangers of our present situation.

We recommend that those in authority, in whatever sector of the nation's activity, work for a speedy discontinuance of all current practices contributing to the eutrophication of Lake Michigan, and that all possible measures to be taken to reverse the process.

We heartily support the ten-point policy position of the Indiana Division, Izzak Walton League (enclosed)

Reclaiming and maintaining a healthy world is going to be expensive. It must inevitably cause changes in our present patterns of living. But it is no longer a debatable issue: the only alternative to making changes is planet-wide disaster.

We accept the price. We urge you to do so, too.

Alpha Chapter
Izzak Walton League
Indiana-Purdue Regional University
Fort Wayne, Indiana 46807
2101 Coliseum Blvd. East.

(1) Prohibitions of any more landfills or alterations of the natural shorelines, coupled with a total evaluation of the social, economic and ecological qualities of Lake Michigan;

(2) Acquisition of an environmental easement along all undeveloped portions of Lake Michigan shoreline, pending results of the total evaluation, at which time decisions should be made as to what portions of the easement should become permanent, and what should be expanded in the public interest and for environmental protection;

(3) Establishment of total effluents standards for ALL discharges to Lake Michigan including the 1 °F above ambient proposed by the Department of the Interior;

(4) A strict constructionist establishment and interpretation of a non-degredation policy for both water and air discharges in the lake context;

(5) A no-discharge policy for all commercial and industrial shipping, including on-board surveillance and enforcement by trained interstate or Coast Guard agents, together with complete environmental control systems and design for all such vessels using Lake Michigan;

(6) Prohibition of any dumping dredged materials from harbors, ship canals, industrial wastes or slags, and similar materials into any waters of Lake Michigan or its drainage basin;

(7) Special Federal and State appropriations earmarked for sewage treatment systems in the Lake Michigan basin, planned for maximum cost effectiveness along lines proposed in 1969 by the U.S. General Accounting Office.

(8) A total prohibition of all persistent pesticides in the Lake Michigan basin;

(9) A general "inland development policy" which would prevent further visual, physical or ecological intrusion on Lake Michigan;

(10) A firm policy with respect to all Lake Michigan ports which would require non-polluting handling of all shipboard wastes and residues, and environmentally designed and operated fueling, servicing and cargo transferring procedures.

MR. STEIN: Any comments or questions?

If not, thank you again.

MR. DOWD: Mr. Dustin, I am Joseph Dowd. I am counsel for Indiana and Michigan Electric Company.

In your statement, you refer only to the work of Dr. Ayers. Are you aware of the testimony or the substance of the testimony that has been presented here this week by Doctors Pritchard, Lee, Dr. Robertson, Dr. Raney, and Dr. Pipes?

MR. DUSTIN: I would say that Dr. Ayers, according to the press release, seems to be the only one willing to be quoted. At least he is the only one quoted in the Fort Wayne press as far as we could see.

Are you aware of the testimony of Dr. Bardach?

MR. DOWD: Yes.

MR. DUSTIN: We hoped that he would be here to handle this thing.

I would like to make a comment. I think it is inappropriate, sir, that we should be willing to gamble the life of Lake Michigan on the say-so of the few men that you retained to provide these responses. There are certainly essential facts associated with thermal pollution. I think that cannot be denied. Reduced contents of oxygen, for example; stimulation of algal growth.

These matters are not of bathtub origin, as Dr. Ayers would like us to believe.

There is a great deal of testimony also to indicate that Dr. Ayers is wrong in the idea that most of the heat is dissipated to the atmosphere. It is, in fact, mixed with the cooler water. The Department of Interior people have suggested that possibility.

Do you have anything else?

MR. DOWD: Would it be correct to say that you are not aware of the testimony of the scientific witnesses presented by Commonwealth Edison during the week?

MR. DUSTIN: We are familiar with some of the depositions that have been filed in the Commonwealth Edison matter, however not in the direct context of this hearing.

However, I have read Dr. Ayers' complete testimony with respect to the Donald C. Cook plant at Bridgman which is essentially the testimony that NIPSCO is relying upon at the Michigan City plant.

Dr. Ayers and his associates, as far as we know, failed to deal with the cumulative effects of thermal pollution in this area, nor with the views of other biologists that the inshore waters are biologically essential for the life and health of Lake Michigan and its source waters that would be most severely affected by thermal pollution, not only from the 80 percent of the thermal pollution for which your particular industry is responsible but from all other sources, too. There are many sources of thermal pollution here in Lake Michigan and, of course, none but a few particular plants in Indiana are so involved.

MR. DOWD: Thank you, Mr. Dustin.

MR. DUSTIN: You are more than welcome.

MR. STEIN: Anything else?

MR. FETTEROLF: Yes. I would like to ask Mr. Dustin a question.

In your testimony, sir, you referred twice to problems with dissolved oxygen and algae in relation to heated discharges.

Could you elaborate on that a little bit?

MR. DUSTIN: Yes. I believe that Dr. Donald Mount of the Federal Water Quality Lab at Duluth has indicated a very substantial shift from healthy diatom food cells toward the green and the blue-green algae as temperature shifts as little as 4 or 5 degrees upward. I have forgotten the exact range, but something like from 82 to 86 degrees, or something like that. It is a very strange shift in the distribution of the different types of algae that would be found in water. It is a simple question of physics. I don't think -- if you would like me to get into this, I am not a physicist guy, you understand -- that warm water simply will not dissolve as much oxygen as cold water. I don't think that is subject to controversy.

MR. FETTEROLF: But you don't have any evidence that this is observed in lakes that have received heated discharges, have you?

MR. DUSTIN: We, of course, have to rely to some extent on biological experts for whom we have respect and who have no reason to be influenced by other sources. Some of these matters have been discussed for me by Dr. William Eberly of Manchester College, who is one of this country's leading limnologists, and I am sure that if you wish I can obtain from him a written statement. He has done some of his postgraduate work at Uppsala University in Sweden, which to my understanding is the outstanding limnology institute of the world. If you would like me to, I am sure we can provide this for the record.

MR. FETTEROLF: I am sure the conferees would be delighted to see it.

MR. DUSTIN: In that case, we shall provide it.

MR. STEIN: Mr. Petersen.

MR. PETERSEN: My name is O. K. Petersen. I am an attorney for Consumers Power Company and I have one or two short questions.

It was my understanding that Dr. Bardach may be here today to testify.

MR. DUSTIN: We hope so.

MR. PETERSEN: Is it merely your hope or do you have reason to believe that he will be here?

MR. DUSTIN: No, I have no information that he will be here.

MR. STEIN: He is listed as one of the people who want to speak.

MR. PETERSEN: Thank you.

You spoke of the Department of Interior -- I take it you are speaking of this report -- the so-called "white paper" -- when you talked of the Department of Interior report.

MR. DUSTIN: The gentleman was referring to Interior's "white paper" on Lake Michigan, and I was countering with the discussion of a "white paper" produced by NIPSCO which is far less meaningful than this one.

MR. PETERSEN: Do your sources agree entirely with the material set forth in this "white paper" as written?

MR. DUSTIN: Well, I -- let me put it this way:

We have only had that document for about 2 or 3 weeks, give or take a little. We haven't had the opportunity to review this with the entirety of the Academy of Science. But if that is another desire of the conference, I am sure we can provide an analysis. We happen to have in Indiana a professional resource chapter. Credentials for membership in that chapter are Ph.D. in one or more of the life sciences. We have forty members in that chapter. We would be pleased to present an analysis of the Department of Interior's recommendations.

MR. PETERSEN: I am merely trying to ascertain your positions, not what you are wanting to do in the future, the basis for your precept.

MR. DUSTIN: If the record is open for 30 days I am sure we can do that.

MR. PETERSEN: The basis for your precept is, in part, this "white paper" as written, as I understand it.

MR. DUSTIN: Yes, sir.

MR. PETERSEN: And the material as to heat and the inshore zone and the retention of heat therein and in the waters of Lake Michigan is part of your theory.

MR. DUSTIN: Yes, and I wouldn't want to quote Dr. Bardach. I think we will let him speak for himself on it.

MR. PETERSEN: Thank you. I have no further questions at this time.

MR. STEIN: Are there any other questions? If not, thank you, Mr. Dustin.

MR. DUSTIN: Thank you.

MR. STEIN: Let me announce the schedule. The way it looks, it is going to be a long, long day. We have to give up this room at 6:00 o'clock, I understand, for a dinner scheduled here. The only breaks we are going to take will be dictated by Mrs. Hall. We may work right through. The conferees may eat lunch at their desks. I realize it is very important for us to get this public testimony. I also know, as I have in the past, in making these pleas or suggestions that you summarize what you are going to say, that it is very difficult for people who are not professionals to summarize, and they feel that they have to read exactly what is in their paper, but I ask you all to cooperate so we can get through at a reasonable hour.

Again, I want to emphasize everyone is going to be heard. and we are going to give everyone an opportunity to present his views.

May we have Mrs. J. F. Voita who has a statement

Mrs. J. F. Voita

of Senator Ralph Smith.

STATEMENT OF MRS. J. F. VOITA,

OAK PARK, ILLINOIS

MRS. VOITA: I would like to speak for myself because I am teriffically interested in Lake Michigan, but the speech that was just made, of which I only heard a part, gives probably all of my feelings and I hope that a great deal of consideration will be given to it. I think that the fact that all of these wonderful organizations are working toward saving Lake Michigan is proof of how important it is. I know that Senator Percy s doing a tremendous job also.

It seems to me that it is very foolish on the part of power companies to talk about the cost of doing it some other way, the right way. When you think of what the cost will be to save or to do somthing about Lake Michigan after we have ruined it, there is no comparison as far as I am concerned.

I wrote a letter to four people from Illinois. One of them was Senator Smith. And I was very much surprised and pleased this morning before I came to have a call from Washington, D. C., saying that he was very sorry that he could not be present but he wanted this statement read. This is it: "I am a co-sponsor of President Nixon's legislation to prevent pollution of the Great Lakes. A clean Lake Michigan is an important factor in the maintenance of a healthy, vital economic climate in the State of Illinois. This goal can be accomplished by strict enforcement of anti-pollution regulations. We must have complete adequate safeguards to control pollution and other detrimental ecological effects of our Great Lakes." Senator Ralph Smith.

MR. STEIN: Thank you.

Are there any comments or questions? If not, thank you very much, Mrs. Voita.

May we have Eileen L. Johnston?

STATEMENT OF EILEEN L. JOHNSTON,
WILMETTE, ILLINOIS

MS. JOHNSTON: My name is Eileen L. Johnston and my home is in Wilmette, Illinois.

Mr. Stein and conferees, thank you for the privilege of speaking before you.

The other day, Mr. Vaughn, engineer of water purification, city of Chicago, said that he was looking forward to my presentation. At that point I didn't know whether I was going to say anything, but I thought if he wanted me to, I would do so, so here I am.

It is going to be a sad day in Chicago when Mr. Vaughn retires. He has been a dedicated man. And, Mr. Stein, speaking of retiring, I think it would be very nice if you and the conferees could send a little message to Mr. Blucher Poole telling him how much we are going to miss him at this table.

MR. STEIN: I miss him already.

MRS. JOHNSTON: I do, too. I miss that Hoosier humor and twang.

MR. STEIN: You have to recognize that no one misses him more than I do. I have worked with Mr. Poole for the past 25 years.

MRS. JOHNSTON: I realize that.

Well, I believe that I am one of the hysterical people that Dr. Raney was referring to the other day. I have been on the environmental beat for sometime now and am thoroughly convinced that man had better take some drastic actions to restore his environment.

May I have the privilege of introducing to the Illinois people -- Mr. Stein, may I have the privilege of introducing to the Illinois people, who may not realize that Mr. Currie is the chairman of our new Pollution Control Board, sitting immediately to my right?

MR. CURRIE: Thank you.

MRS. JOHNSTON: In 1968 I made a statement before this conference and stated: "We must restore all of Lake Michigan to pure water including its tributaries. This wonderful lake is actually one big well for the use of the people of four States and it should be treated as such. Who would throw sewage, chemicals, oil, heat, pesticides down the well and expect to survive?

"No individual, Federal installation, State installation, municipality, or industry has the right to put anything into our source of water -- the lake. Lake Michigan is not the four-State dump for municipal and industrial wastes, pesticides, thermal pollution, boat wastes. Let's clean up this big well, then keep it that way. We are making progress with legislation. With proper enforcement and continued research we should be able to do the job.

"The public needs education. We need a new value put on our most valuable resource throughout the Nation. It is going to cost us money for pure water. Let's face it and go to work."

An article by Harlan Draeger in the Chicago

Daily News of August 3, 1970, quoting Mr. Mayo, Mr. Dumelle, and Mr. Miller shows clearly that we are not making progress in the lake cleanup despite efforts of industry. Are we wise to even consider putting more heat into the lake? Mr. Stein, are you able at this time to give us an approximate date for a reconvening of the Calumet Enforcement Conference? It is long overdue. Mr. Stein?

MR. STEIN: Yes, Mrs. Johnston. I note you have attended these things and know how they work and, again, you know I am the Chairman of the conference and the representative of the Secretary. The Secretary of the Interior directs the reconvening and the calling of these conferences. Very often he asks me to call them in my delegated authority, but I do think that we will be in touch with the other States and make a recommendation to the Secretary of the Interior on that.

I have no statement now on the reconvening of the conference. We have two things to consider: 1) We have special problems such as this thermal problem; and 2) all of these States have busy programs, and part of the counter-program is that we just have to keep the conferences down so they can do their work. Just preparing for these conferences takes a tremendous amount of staff work on the part of the State agencies and everyone else. We try to hold them as frequently as we think they will do the most good, but we will take that up with the States, and I think we can give you a judgment on that after I have checked with the people back at the ranch in Washington, and we will do so.

MRS. JOHNSTON: I urge other citizens to do so because the last time this was -- this was in August of 1969 and things are not very good down in that part of the lake.

It was pointed out by this study to Mr. Dumelle and Mr. Mayo brought it out.

My position has not changed one bit from 1968, so you see I do endorse the Department of the Interior position of September 1970. It was a teriffic meeting and I think, Mr. Stein, it might be very worthwhile to have the highlights of that meeting published so that people can obtain it.

I have toured the Ann Arbor laboratory and I have observed experiments going on over there, talked with the research men, and heard them speak at conferences on research.

Mr. Frangos, I have a question for you. Last spring I toured the Jones Island Treatment Plant in Milwaukee, and the superintendent told me they would be chlorinating the effluent by the end of the year. Now, this is October. Do you know what progress has been made? In view of the big discussion that took place at Milwaukee, I feel it should be brought up at this time.

MR. FRANGOS: Well, the superintendent has been telling me -- and we didn't understand that as a commitment legally to our agency, Mrs. Johnston -- but they are proceeding along the timetable that we have established in the State of Wisconsin. They are not chlorinating as of this date nor will they be chlorinating this fall. Their schedule is for next fall.

MRS. JOHNSTON: The superintendent should not have told me that they were going to be chlorinating by the end of the year if that is the case.

I urge a speedup of the phosphate deadline in sewage treatment effluent. We have the technology. In fact it is being applied in Milwaukee. Both Mr. Vaughn's and Mr. Dumelle's papers bring out the urgency of immediate action.

We must keep in mind we are talking about a very sick lake full of lead, mercury, oil, radioactive wastes, arsenic, pesticides, nitrates, phosphates, heat, and we just don't know the whole story. The ill effects of any one of the pollutants might be so harmful, but the synergistic effect may be so ominous.

I respect Commonwealth Edison for their study plan and for the caliber of the research men who testified for them. Certainly no man has studied Lake Michigan more than Dr. John Ayers, and I have always had great respect for Dr. Ayers. They do have problems that are difficult but that can be solved. This, of course, applies to the other power companies around the lake. The public will, I am sure, be willing to carry its fair share of the cost of alternate methods to once-through cooling when it is made fully aware of the alternative.

I realize the outcome of this conference will be based on the judgment of extremely competent men. I have all of the faith in the world in you conferees. I just hope you will remember the small voice of the citizens in your deliberations, and there is one other thing I would like to mention, please, Mr. Stein. A lot has been said about the heat input from other industries other than power, and when we toured U. S. Steel down in Gary -- remember, Mr. Stein -- in, I think, it was 1968 -- that brand new facility -- I was really shocked and amazed when I asked the man the temperature of the effluent and it was 11 degrees warmer than the input.

MR. STEIN: Thank you. Are there any questions?

You know, Mrs. Johnston, I was surprised it was that low considering what they ran that water through.

MRS. JOHNSTON: Really?

MR. STEIN: Sure. You saw the heat of that steel.

MRS. JOHNSTON: Oh, yes.

MR. STEIN: And what they subjected it to.

MRS. JOHNSTON: But when you think of all of the industries down at that end of the lake, and Mr. Morton or Mr. Schneider at the Lake Erie Conference, wasn't there some discussion in the auditorium on the future industry building down there for awhile?

MR. STEIN: Well, I didn't hear that. Again -- and you know you raise a question here and a lot of people have talked about this -- let me make one thing clear: I don't think that people either in the State water pollution control agencies or the Federal water pollution control agencies have any authority over land utilization and I am not sure you people would want us to have that. The land utilization has traditionally been a local responsibility. Usually the States control it, certainly not the Federal Government, except when you are dealing with the Federal lands, of course, but with non-Federal lands we don't.

The point is, however, once a decision is made by the local people of land utilization, we do have the powers to assure that the environment is protected, and this must be borne in mind. I think when people talk to us about putting a moratorium on sites or on uses, I am not sure they recognize 1) the limits of their authority or 2) the implications of that kind of request, to put the Federal Government in that type of business. I am not sure you would like to live under that sort of Government in this country.

MRS. JOHNSTON: Thank you.

MR. STEIN: Thank you.

Frank Pierson.

STATEMENT OF FRANK PIERSON, SPOKESMAN, CAMPAIGN AGAINST POLLUTION, CHICAGO, ILLINOIS

MR. PIERSON: My name is Frank Pierson. I am representing the Campaign Against Pollution here not so much as a technician, but as a concerned citizen, conveyor of peoples' sentiments, and so on.

We just turned in a copy of our formal technical testimony and I won't trouble you with it here. I am here to stress a single point and to ask some extremely simple questions.

The problem of thermal pollution has been discussed throughout Chicago and the suburbs. The people of Chicago and the suburbs, the thousands of us who constitute the campaign against pollution and other sympathizers have come to the following conclusions which we feel is the only human conclusion: There must be no discharges of heat into the lake by a power company. We won't tolerate those discharges. And when I say this, I am talking about some very worked up, very adamant people.

We pledge ourselves to be unrelenting in the fight against heat discharges of any magnitude by the power companies. We insist that these companies must employ closed cooling systems and that people won't be fooled by phony demonstration projects designed to conceal the fact that those projects propose a thermal pollution threat.

So we ask you gentlemen for a favorable answer and we hope that it will come soon. The longer you wait, the more certain we become that you are dickering behind our backs with big corporations, and we are positive that you have the interest of big money and not the people at heart.

That concludes what I would like to say.

I would like to ask Chairman Stein a question, and that is when he expects this body will make a decision concerning the matters that are being discussed today.

MR. STEIN: Well, a lot of people have contributed many attributes to me which I don't have, and I appreciate being given the wonderful clairvoyance, but I can't predict that.

We have a group of five conferees, all independent thinkers. We have had some very complicated information presented before us. We are not completed yet. I think if you want to wait until the wee hours of this morning or tomorrow, I will be able to give you a better judgment when this is complete and I have consulted with the other conferees.

MR. PIERSON: Well, may I ask this: Can you say that you will have a decision by the end of October?

MR. STEIN: Any decision that we have will depend on actions of many people other than myself. I can't speak for them. I will try to get a decision as rapidly as I can. From my personal point of view, I would hope that the conferees would be able to come up with a determination within a couple of weeks. I haven't spoken to them and I have no notion of what they want to do. This is, again -- and you are asking the kind of question that people ask about timetables in enforcement cases and when things are going to be done. But this depends on the determination of third, fourth, fifth parties, and one person doesn't handle all of the strings and is not able to make all of these judgments. I think my function here is to hold everyone's nose to the grindstone to be sure that there are no dilatory tactics used and we arrive at the decision as rapidly as is humanly possible.

MR. PIERSON: Could I tell my people, then, that we could expect a decision -- at least a recommendation -- from this body within, say, 2 weeks?

MR. STEIN: You can tell your people that but please don't tell them I said it.

MR. PIERSON: Let me ask one more question: Will this body be meeting with industry before a decision is made other than in this hearing here?

MR. STEIN: I don't think the body will meet with industry. Let me make another thing clear: As a public official, and I guess maybe the others, I have an open door in my office, and whether you or a citizen group, industry, or anyone wants to come up and see me, they are always welcome. I don't know that anyone wants to come up, but I don't feel as an official we can close the door to anyone. I think it is fairly clear on our record that when we meet in a body with people who have an interest in pollution control, we do this in a public manner. I have said this again and again. We are a public agency doing the public business in a public manner. If you think that the implication is there are going to be any private meetings, large meetings that no one knows about, the answer is no.

MR. PIERSON: Would you do us this favor then? If and when some of the power companies would like to get together with you, would you invite us to those occasions so that we can present the citizens' viewpoint?

MR. STEIN: Well, again, we don't operate, in a sense, that way, and I have talked about this many, many times. If you want to meet with me, I am not sure I will invite the power companies or anyone of that kind.

I think, an essence of our society -- and I know your group has been here before and I have put this out before -- an essence of our society is a right of privacy. Privacy doesn't mean secrecy, and we respect that right of privacy of every citizen as a basic constitutional right. And if I want to have a private meeting with my wife or my children, I don't think that anyone has a right to ask to come in. I think if any one of the group here wants to come into my office or anyone else's office or just meet on a personal or other basis, we will have that meeting. I will assure you one thing. I am sure the other people here do this. Nothing I do officially is governed by confidentiality or secrecy. Every public operation we have will be fully disclosed.

MR. PIERSON: I would like to say that I think this is a public issue and not a private one of the sort you referred to, and I think that the people should be represented at even the small gatherings where decisions might, in fact, be made without our knowing it.

I presume that this wouldn't be a situation in which you are trying to conceal some sort of negotiation.

MR. STEIN: No decision is going to be made without your knowing it or anyone's knowing it. But, by the same token, in the ordinary conduct of any public business I may have between, oh, I don't know maybe 10 or 15 people in the course of a day coming into my office on special pollution problems, a lot of them spend considerable time and expense in coming to Washington to see a public official. Before they could get past that phalanx of secretaries in my outside office, if I had to tell each one of them that before I could see them, I would have to notify someone else who might have a remote interest in what they were concerned with so they all could go to the meeting, I think we would have a sorry kettle of fish. We just don't do business this way, and I think you have to recognize we are operating within our society.

Sir, I have got one more thing to say: If you don't have confidence in your public officials and if you don't think that we are going to represent the public interest in all our dealings with whoever we deal with in the best way, public or private, then it is up to the people to get rid of us. But we have to have that mutual faith and confidence if we are going to do business.

MR. PIERSON: We think you represent us but we would just like to help you out a little bit.

MR. STEIN: We appreciate it. Thank you.

May we have Arthur Pancoe?

STATEMENT OF ARTHUR PANCOE, SAVE - CAMPAIGN AGAINST POLLUTION, GLENCOE, ILLINOIS

MR. PANCOE: I want to thank you gentlemen for the opportunity to testify. My name is Arthur Pancoe, a resident of Glencoe, Illinois. I am here as a scientific director of SAVE and also Campaign Against Pollution.

I have a graduate degree from Northwestern, and Master's from Northwestern University, and I expect to discuss this problem from a slightly different point of view.

The use of Lake Michigan for thermal discharge from nuclear plants constitutes only a temporary home for the heat. When considering the possible damage from this discharge and realizing that the heat will in turn be dispersed into the atmosphere in a relatively short time, the question arises: Why not emit the heat to the atmosphere originally via cooling towers? Taking into account seasonal, and shorter range temperature variations, the heat will remain in the lake approximately 10 days on the average. (Ref. 1) It seems ludicrous to take a chance with the quality of the lake under such circumstances. The total consequences of depositing large amounts of heat in the lake cannot now be determined accurately. The probabilities indicate that if damage does occur, it will not be apparent until years or even decades in the future. And should danger signs occur from the heat, could the plants in existence even be reoriented?

The St. Louis-based Committee for Environmental Information in March 1970 estimated that "In the year 2000 if power consumption continues to increase and there is no corresponding increase in overall efficiency powerplants of all kinds will dispose of roughly enough waste heat to raise by 20 degrees the total volume of water which runs over the surface of the entire United States." The committee had more dire conclusions with regard to carbon dioxide and radiation contamination that will result from such plants. But these problems are not pertinent to the subject being considered.

There are some calculable parameters that can be of use in judging whether a risk can occur in certain areas. It can be roughly determined that the heat input to the lake from all plants by 1990 would be less than 1 percent of that supplied by the sun on a clear early summer day. (Ref. 2) This figure on a superficial basis appears to make the entire question of thermal pollution moot. However, if we are sagacious about this figure and if additional aspects of man-created heat are taken into account, our complacency will soon disappear.

First, unlike the sun, the plants will supply heat to the lake continuously, with no interruptions by either darkness, cloud cover, haze, cold days, or cold seasons of the year. Also the heat will be injected entirely into the inshore portion of the lake at depths of less than 10 meters and into an area representing less than 8 percent of the lake's surface. Under these more concentrated conditions the input in the area affected will represent approximately 10 percent of the solar generation again on a clear summer day. (Ref. 3) It is now important to discuss a process by which this heat in the shore areas will be concentrated, perhaps dangerously, in the spring of the year.

During this time a phenomenon occurs which is not unusual in lakes but particularly prevalent at times in Lake Michigan. This is a condition in which a thermal bar of water (i.e., water at its maximum density 4 degrees centigrade) is established offshore forming a barrier which allows little horizontal mixing between inshore and the much larger offshore volume of water. This condition can last days or even weeks. The heat which is already concentrated in the inshore area will be trapped and will spread out in a thermal plume traveling great distances along the shore. As spring proceeds and the bar moves farther offshore, usually sometime in June, the thermal mixing of the lake will return to normal. However, with regard to possible biological harm, this intense inshore concentration of heat occurs at precisely the most sensitive time of the year. (Ref. 4)

A. Pancoe

J. J. Resia of the Department of Biological Sciences, Northwestern University, formulated a detailed description of the danger to the fish population from this phenomenon. (Ref. 5) I have attached herewith a detail of his statement.

Another problem that bears consideration is possible fish kills resulting from upwellings about thermal plumes. Such kills have already been documented with regard to fossil plants. (Consumers Power, Port Sheldon, August 29, 1968) As discussed by Resia, fish population will be attracted to the areas of heated discharge.

It is well established that the greatest danger to a fish population about a plume exists from temperature drops occurring from a sudden upwelling of cold bottom water. Therefore, the critical upper limit of discharge is governed by this factor and not the upper lethal temperature of a given species. The maximum acclimation temperatures for the game fish in Lake Michigan make it doubtful if any major heat discharge does not involve a risk. (Ref. 5) These allowable acclimation temperatures are well below proposed discharge temperatures of the plants. But, more startling the recommended maximum discharge temperatures are below natural maximum monthly surface temperatures.

(Ref. 6) Thus, safety to the fish population, from even the proposed strong 1-degree limitation above ambient now being considered, is negated.

More important than ambient standards is whether any major heat discharges should be allowed. As described earlier, large amounts of heat are continually added in the spring of the year to a rather limited volume of water. Even though this is accomplished by diluting the heat in large volumes of water, the increase in lake temperature inshore will be precisely the same as if the heat were added at a more severe temperature originally.

At this point, I wish to digress. It is my contention that the various standards being suggested for discharge into the lake all provide precisely the same safety to the lake: none at all. I want to strongly emphasize this point if no other point in my statement. The public, in my opinion, is being misled, and I certainly do not think, in the case of this board, purposely, by the 1-degree standard into believing the lake is protected. I do not think the public has been fully cognizant of the fact that the main free ride is given by the lake itself. There is roughly a 15- to 25-degree temperature change between the water at the point of intake and the outfall point during 10 months of the year. I want to strongly emphasize this point. I think the 1-degree, again -- not intentially by this board -- is a coverup. If I were the power company, I could live within this 1-degree temperature standard very easily and accomplish the exact same damage, if there be damage to the lake.

As I pointed out earlier, I do not think that it is even fair to put the power companies to the expense of going through various contortions to live within this standard. The question is: Will the heat harm the lake?

Now, I want to make a little statement here about scientists, and this will cover all sides of the question.

MR. STEIN: Mr. Pancoe, when we put you on, you indicated you would take 10 minutes. Are you going to adhere to that?

MR. PANCOE: I am going to end with the statement on this one point, because I think it is the only point I have to add to the discussion. I don't think any scientist either for or against this heat discharge can honestly say that it either will or will not harm the lake.

Einstein in his later years said that his present theories of relativity are more than likely nearer to a correct prediction than the former Newtonian laws, but that his laws will then be improved upon as time goes by by other scientists.

Thus, when any scientist says that he unequivocally can state that there will be no damage to lakes from heated discharges, I think this man is possibly dishonest. I likewise feel that anyone who says that heated discharges will definitely harm the lake is equally dishonest.

With this in mind, I think that the real question here is: We do not know.

And with this, I want to close by stating that I don't think that the heat should go into the lake. It can go just as easily under less stringent standards as under the previous 5-degree standards.

I don't think the harm comes from the temperature the water is put in, but from the cumulative effect and the total number of B.t.u.'s put into the lake will be precisely the same in either case.

Thank you.

MR. STEIN: Did I understand you, Mr. Pancoe?

Your proposal is that power companies or industrial plants not be permitted to put any heated water into the lake. Is that correct?

MR. PANCOE: That is my proposal.

Either the power companies should be allowed to put the heat in or not allowed to put it in, and I think I could show them if no one else could how to put the heat in under the 1-degree standard.

MR. STEIN: Are there any other comments or questions?

If not, thank you very much, Mr. Pancoe.

MR. PANCOE: Thank you.

(Mr. Pancoe's presentation follows in its entirety.)

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NORTH SHORE AFFILIATE
OF
C. A. P.

September 11, 1970

SHOULD THERMAL DISCHARGE INTO LAKE MICHIGAN BE ALLOWED?

The use of Lake Michigan for thermal discharge from nuclear plants constitutes only a temporary home for the heat. When considering the possible damage from this discharge and realizing that the heat will in turn be dispersed into the atmosphere in a relatively short time, the question arises; why not emit the heat to the atmosphere originally. (via cooling towers) Taking into account seasonal and shorter range temperature variations, the heat will remain in the lake approximately ten days on average. (ref. 1) It seems ludicrous to take a chance with the quality of the lake under such circumstances. The total consequences of depositing large amounts of heat in the lake cannot now be determined accurately. The probabilities indicate that if damage does occur, it will not be apparant until years or even decades in the future. And should danger signs occur from the heat, could the plants in existence even be reoriented?

The St. Louis-based Committee for Environmental Information in March, 1970 estimated that "In the year 2000 if power consumption continues to increase and there is no corresponding increase in over all efficiency power plants of all kinds will dispose of roughly enough waste heat to raise by twenty degrees the total volume of water which runs over the surface of the entire United States." The committee had more dire conclusions with regard to carbon dioxide and radiation contamination that will result from such plants. But these problems are not pertinent to the subject being considered.

There are some calcuable parameters that can be of use in judging whether a risk can occur in certain areas. It can be roughly determined that the heat input to the lake from all plants by 1990 would be less than 1% of that supplied by the sun on a clear early summer day. (ref. 2) This figure on a superficial basis appears to make the entire question of thermal pollution moot. However, if we are sagacious about this figure and if additional aspects of man created heat are taken into account, our complacency will soon disappear. First, unlike the sun, the plants will supply heat to the lake continuously, with no interruptions by either darkness, cloud cover, haze, cold days, or cold seasons of the year. Also the heat will be injected entirely into the inshore portion of the lake at depths of less than ten meters and into an area representing less than 8% of the lakes surface. Under these more concentrated conditions the input in the area effected will represent approximately 10% of the solar generation again on a clear summer day. (ref. 3) It is now important to discuss a process by which this heat, in the shore areas, will be concentrated, perhaps dangerously, in the spring of the year.

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During this time a phenomenon occurs which is not unusual in lakes but particularly prevelent at times in Lake Michigan. This is a condition in which a thermal bar of water, (i.e. water at its maximum density 4°C.) is established offshore forming a barrier which allows little horizontal mixing between inshore and the much larger offshore volume of water. This condition can last days or even weeks. The heat which is already concentrated in the inshore area will be trapped and will spread out in a thermal plume traveling great distances along the shore. As spring proceeds and the bar moves further offshore, usually some time in June, the thermal mixing of the lake will return to normal. However, with regard to possible biological harm, this intense inshore concentration of heat occurs at precisely the most sensitive time of the year. (ref. 4)

J. J. Resia of the Department of Biological Sciences Northwestern University, formulated a detailed discription of the danger to the fish population from this phenomenon. (ref. 5)

Another problem that bears consideration is possible fish kills resulting from upwellings about thermal plumes. Such kills have already been documented with regard to fossil plants. (Consummers Power Port Sheldon, Aug. 29, 1968). As discussed by Resia, fish population will be attracted to the areas of heated discharge.

It is well established that the greatest danger to a fish population about a plume exists from temperature drops occuring from a sudden upwelling of cold bottom water. Therefore the critical upper limit of discharge is governed by this factor and not the upper lethal temperature of a given species. The maximum acclimation temperatures for the game fish in Lake Michigan make it doubtful if any major heat discharge does not involve a risk. (ref. 5) These allowable acclimation temperatures are well below proposed discharge temperatures of the plants. But, more startling the recommended maximum discharge temperatures are below natural maximum monthly surface temperatures. (ref. 6) Thus, safety to the fish population, from even the proposed strong 1° limitation above ambient now being considered, is negated.

More important than ambient standards, is whether any major heat discharges should be allowed. As discribed earlier, large amounts of heat are continually added in the spring of the year to a rather limited volume of water. Even though this is accomplished by diluting the heat in large volumes of water, the increase in lake temperature inshore will be precisely the same as if the heat were added at a more severe temperature originally.

Another field of concern is the effect on alge growth, (blue-green) resulting from removing large volumes of nutrient, enriched water from the hypolimuion (the cold bottom layer), warming the water, returning it to epilimnion (the warmer top layer), and thus

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increasing the growing season in the surface waters. Additional secondary effects possibilities are depletion of oxygen in the bottom waters in summer, changes in species composition, numerical relationships in lake plants, and animal populations. (ref. 7) Clarence A. Carlson of Cornell in a paper entitled "Ecological Impact of Nuclear - fueled Power Plants" states many other considerations not mentioned.

a) Due to inefficiency of nuclear plants 60% more waste height is released to cooling water per K. W. than fossil - fueled plant causing great extremes of conditions via vie fossil plants.
b) Temperature is important to aquatic organisms as a lethal, directive, and controlling factor.
c) Increase in temperature will increase the rate of metabolism and oxygen consumption in aquatic organisms while concurrently decreasing the oxygen - dissoling capacity of the water.
d) Increased temperature generally stimulates growth of taste and odor producing organisms.
e) formation of sludge gas
f) multiplication of saprophytic bacteria and fungi
g) consumption of oxygen by putrefactive processes
h) warming of water likely to increase suseptibility of fish to certain disease organisms and metabolic poisons.

He also states that less than 5% of the 1900 fish species found in U. S. have been studied with respect to temperature response.

The Fishery Resource Management paper "Some Adverse Effects of Thermal Pollution of Aquatic Ecosystems" suggests other dangers from thermal discharge. (ref. 8)

Since means of disposing of the heat directly into the atmosphere are available why take any risk with the lake?

Arthur Pancoe

Arthur Pancoe
Scientific Director of SAVE

References
1, 2, 3, - C. H. Mortimer, Director, Center for Great Lakes Studies Zion, Ill. May 2, 1970
4, 5, 6, - See attached
7 - Alfred W. Eippen, July 3, 1970, American Society for Advancement of Science
8 - See attached

Table 3. Recommended seasonal maximum temperatures for spawning and depths at which spawning has occurred in Lake Michigan

Species	Season	Depth (ft.)	Temperature (°F)
Lake Trout	Oct. - April	60[1]	50[5]
Lake Herring	Nov. - April	10[2]	46[6]
Lake White Fish	Nov. - April	10[2]	43[7]
Yellow Perch	April - May	10[1] [3]	64[8]
	Jan. - March	60[4]	45[8]
Channel Catfish	May - June	10	82[9]
Coho Salmon	Fall	-	Streams

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[1] Keller, M., 1969. Personal communication.
[2] Koelz, 1929.
[3] Wells, L., 1969. Personal communication.
[4] Wells, 1968.
[5] Embody, 1934.
[6] Unpublished data, BCF, Ann Arbor, Michigan.
[7] Price, 1940.
[8] Unpublished data, NWQL, Duluth, Minnesota.
[9] Sneed, K. Personal communication.

Ref. 5

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"One thing which definitely is not needed in the current debates over effects of waste heat from nuclear power plants on Lake Michigan is another biologist who takes the position of an advocate. I therefore must preface my following remarks with a brief bit of philosophy.

With few significant exceptions, predictions of resultant harm to the Lake's biota are honestly debatable. When specialists in pertinent fields disagree, the issues become quite clouded and confusing to the public. The clouds part a bit, though, if the layman keeps two things in mind.

First, the empirical, inductive method to which modern science is wedded never "proves" or disproves" anything. No matter how dogmatically some scientific "truths" often are taught, it must be remembered that at the philosophical foundation of scientific method is a rule which says that the most an investigator can hope to accomplish by his experimental results and interpretations is to cause one hypothesis or another to seem more or less likely to be true. Hence, competent scientists, honestly attempting to be objective, can and often do disagree.

This brings us to the second point. The current environmental quality crusades in general and the nuclear power plant controversies in particular have seen too many scientists showing too little regard for objectivity. Abuses of this nature seem to come from both sides of almost every confrontation. It can be maddening for a scientist to try to refute a less idealistic oponent's "absolute certainties" with wishy-wasny "it appears thats" and "the data suggest thats." Nevertheless, scientists and engineers who myopically pander either to their employers' vested interests on the one hand or to crowd response on the other do service to no one and, I fear, are going to learn that in the long run, their credibility and that of their profession is as fragile as it is valuable.

Granted the above, I would like to describe a problem which I feel has not yet been given any real attention by those about to decide what can and can not be done with waste heat in Lake Michigan.

In the temperate latitudes in which we live, organisms are forced to adjust their life cycles to the rigors of changing seasons. Mother Nature has been very fussy about compliance, and those species which failed to synchronize became evolutionary drop-outs. One well-known environmental cue that is widely used by plants and animals as a season-indicator is photoperiod, the changing length of the day. Thus, many birds, for example, are "told" when their gonads should ripen, when they should mate, and when they should fatten up and migrate by the lengthening or shortening daylight hours.

For terrestrial organisms, as well as for those which are found in rivers and streams (lotic environments), photoperiod is a cue far more trustworthy than temperature. For the biota of lakes and ponds (lentic environments), however, seasonal temperature changes usually are pretty consistent (especially in large lakes), and it is well-known that for many lentic species (notably, fishes), water temperature plays the principal role in seasonal synchronization.

Since the effects of thermal discharges, present and proposed, on the overall temperatures of Lake Michigan can be considered insignificant (which, possibly, is why Commonwealth Edison spokesmen have mentioned them so often), and since the plumes of heated water will be small in relation to total Lake area, it is not immediately evident that a significant proportion of any population in the Lake could be affected adversely.

There is more to the story, however. In the first place, the littoral (nearshore) areas of any large body of water are by far the most biologically important. In these littoral areas, Nature provides light and nutrients in relative abundance, and productivity is high. Since populations always produce more offspring than the environment can support, and since the principal limiting factor in the survival of offspring of most aquatic animals is food availability, natural selection has "taught" the great majority of species to reproduce in littoral waters. Thus, these near-shore areas, into which the nuclear plant effluents are to be directed, see a lot more biological traffic than comparable off-shore areas. Included in this relatively congested situation are those fishes which are spawning, those which have been spawned, and those predators desirous of eating spawner or spawnee.

We understand, then, that biomass is relatively large in the general vicinity of the proposed heated effluents, but the story goes further. Most animals have preferred temperatures. This means that their activity is less at one temperature than at any other. In fishes, for example, an individual's preferred temperature depends on such factors as species, previous thermal history, age, physiological state, time of day and year, and many other things, known and unknown, but it may be generalized that if a group of similar fish are placed in a thermal gradient, they will tend to congregate at their preferred temperature in a sore of "gapers' block" effect.

I have heard the advocates of "thermal enrichment" speak enthusiastically of fishing "hot spots" produced by power plant discharges. Such phenomena are produced when ambient water temperatures are below the preferred temperature of fish in the general vicinity of a heated plume. When the fish congregate at their preferred temperature in the gradient caused by the plume, a fisherman's bonanza results.

But there may be a catch to this. I have already discussed why fishes tend to be in the general vicinity of the thermal plumes, and how they can tend to move to positions in the plumes where temperatures are above ambient. Such situations already exist on small scale in Lake Michigan. But if to these considerations we add the proposals for a growing number of large discharges from nuclear plants, we must conclude that greater percentages of the Lake's fish populations would be spending greater amounts of time at temperatures above ambient.

Besides having other, more well-known, physiological effects, water temperature (as mentioned previously) is the principal seasonal timer for many species of fish. In effect, progressive changes in the ambient temperature of the Lake "tell" a fish when to begin and complete gonadal development, when to feed, when to migrate, and when to spawn. Thus, each species of fish is influenced to perform some or all of these activities at a time of the year most advantageous for survival of the population. It must be noted that the physical characteristics of the season are not the only reasons why timing is important. Spawning, for example, must be performed simultaneously by the greatest possible proportion of the population, for maximum efficiency, and the larvae must latch in synchrony with the often ephemeral availability of important food species (which also are influenced by temperature).

Add to all of these considerations the complex, seasonally-variable food-web interactions in the Lake, and one begins to understand the validity of questions raised about fishes spending time in the proposed "hot spots" rather than in waters of ambient temperatures. The temperature a fish "likes" bears no necessary resemblance to the temperature that is good for survival of its population.

I have heard attempts by some to defend calefaction on the grounds that elevated temperatures have no adverse effects on certain aquatic animals from arctic or tropical latitudes. I have also heard it mentioned that in certain fish culture practices, people spend money to heat ponds to increase yield. In answer to the latter, it should be noted that such people also have to feed the fish in those cultures. Cultures are not ecosystems. And in answer to both, we need only keep in mind that we are concerned with temperate latitude fishes trying to stay alive and obtain food in a temperate latitude lake.

Finally, I wish that discussions of ecological effects of waste heat could rise above naive considerations of what is lethal to adult fishes. There's more than one way to skin a population, and knocking out reproduction sounds to me as though it might be fairly effective."

J. J. Resia
Department of Biological Sciences
Northwestern University

Table 2. Lethal temperatures for some Lake Michigan fishes.

Species	Acclimation Temperature (° F)	Lethal Temperature (°F)	
		Upper	Lower
Channel Catfish[1]	77	92	43
	68	91	41
	59	86	32
	50	82	32
Lake Herring[2]	77	78	48
	68	79	39
	50	75	37
	36	67	33
Lake Trout[3]	68	73	(34)
	59	73	(34)
	46	(69)	(32)
Coho Salmon[4]	73	77	44
	68	77	40
	59	76	38
	50	75	35
	41	73	32
Yellow Perch	77 Summer[1]	90	48
	77 Winter[5]	86	40
	59	82	32
	50	77	32
	41	70	32
Gizzard Shad[4]	77	93	50

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[1] Hart, 1952

[2] Unpublished Data, BCF, Ann Arbor, Michigan

[3] Parenthesis denotes estimates from short term tests.
Huntsman and Sparks, 1924.

[4] Brett, 1952

[5] Hart, 1947

Table 1. Recommended monthly maximum surface temperatures for heated discharges into Lake Michigan.

Period	Lake Michigan[2] Surface[1] Temperature (° F)[3] Maximum	Minimum	Recommended Monthly Maximum Surface Temperatures
Dec.	50	33	55
Jan.	42	32	50
Feb.	37	37	50
March	37	32	50
April	44	32	50
May	53	36	55
June	65	42	70
July	71	50[4]	85
August	74	50[4]	85
Sept.	72	50[4]	85
Oct.	65	50	85
Nov.	54	42	70

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[1] Surface temperatues are the BT readings recorded at 0.0 feet.

[2] Excluding Green Bay. Surface temperature range in Green Bay in June, 1963 was 15.9 - 25.0° C and in July, 1963 24.3 - 17.7° C.

[3] From stations less than 5 miles from shore and away from river mouths contained in: Lake Michigan Basin Office, BT Data, 1962 and 1963 and for winter months from Noble and Michaelis, 1968. "Winter temperature data from Federal Water Pollution Control Administration, (Great Lakes - Illinois River Basin Project) Buoy Stations."

[4] Personal communication, Mr. John Carr, BCF, Ann Arbor, Michigan.

Ref 8

Cons. 441
Fishery Resource Management

November 6, 1969

SOME ADVERSE EFFECTS OF THERMAL POLLUTION ON AQUATIC ECOSYSTEMS

I. Through habitat changes

A. Aquatic plants

1. Overstimulation of plant growths present.
2. Shift to less desirable plant forms.
   Eg. from diatoms or greens to blue-greens.

B. Reduction of water body's capacity to decompose organic wastes

1. Increased decay → overutilization of dissolved oxygen in local area, hence lowered decomposition capacity downstream.
2. Stratification isolates organic matter in anaerobic bottom waters.

C. Increase stratification period

1. Degraded conditions for fish in hypolimnion (protracted O_2 depletion, food consumption, etc)
2. Longer growing season in epilimnion.

II. Through effects on aquatic organisms themselves

Perspective: Temperature responses have been studied in less than 5% of the approximately 1,900 species of North American fishes. To date virtually all of these have been studies of short-term temperature effects.

A. Death directly caused by heat

1. Thermal shock (sudden)
   a) Through condenser cooling cycle
   b) Into or out of plume of heated water
2. Heat death (gradual)
3. Death in early life stages
   a) Before hatching
   b) Directly after hatching
   c) Deformity → abbreviated life span

(continued on p. 2)

B. Death thru indirect ecological effects of elevated temperatures

1. Accelerated metabolism + lowered O_2 carrying capacity of haemoglobin = Greater need for O_2 in env't. But higher temp → lower O_2 in water. Results:

    a) Extreme cases: Asphyxia

    b) Less extreme: Weakening. This, plus more direct effects of higher temp., can produce:

        (1) Lowered resistance to toxic substances (copper, cyanide, insecticides, detergents, etc.)

        (2) Lowered resistance to fungus or disease, plus more rapid proliferation of many pathogens.

        (3) Decreased ability to forage, escape predators, etc.

2. Disruption of food supply through changes in hatching dates and/or growth rates.

    a) Heavy mortality of food organisms hatched too early in spring. (Example: mayflies hatched in March unlikely to survive or reproduce.)

    b) Food organisms of suitable size no longer available when needed by predators (Example: Small walleyes heavily dependent on larval perch.)

    c) Larvae induced to move into areas not rich in plankton.

3. Interference with spawning activities of adults.
    a) Block migration.
    b) Physiol. trigger fails at too rapid rise.
    c) Trigger missing if temp. never reduced?

C. Changes in species composition, through:

1. Competitive replacement by spp. more temperature tolerant

    Example: 72F. optimum for lgmth bass, not for trout

2. Competitive replacement by creating conditions more favorable to growth and/or reproduction of other spp.

    Examples: Longer growing season + higher temp. might cause alewives to reach spawning size at Age II instead of III.
    Longer growing season can provide opportunities for more spawning in one season (certain spp.)

A. W. E.
441-42/2

MR. STEIN: Mrs. Lee Botts.

STATEMENT OF MRS. LEE BOTTS, OPEN LANDS PROJECT, CHICAGO, ILLINOIS

MRS. BOTTS: Mr. Chairman, conferees. I am Mrs. Lee Botts representing the Open Lands Project, a private nonprofit conservation organization with offices at 53 West Jackson here in Chicago. My chief responsibility on the project staff is to serve as executive secretary for the Lake Michigan Federation that has been organized as a clearinghouse for conservation and civic groups in the four States that border Lake Michigan.

For this conference, as for the Illinois Pollution Control Board hearings last week, I have been authorized by the Project Board of Directors to urge that the Department of Interior be supported in its effort to protect Lake Michigan from possible thermal pollution. This position was necessarily taken without consideration of the lengthy and sometimes detailed and factual presentations made here this week in opposition to the Interior recommendation. Yet after hearing most of the testimony given this week and studying most of what I did not hear in written form, I must still conclude that a strict thermal standard is the only means now available to assure prevention of damage from thermal pollution. It is a danger I and some scientists who have not been retained as consultants to utility companies still consider the likely consequence of use of Lake Michigan waters for once-through cooling in the quantities required by nuclear plants and the large fossil fuel plants now contemplated on its shores.

This conclusion has been reached not so much because of the strength of the Interior reports issued in defense of its proposal as because of the weakness of the alternatives offered by those who have demonstrated historically that their chief aim is to produce electricity as cheaply as possible regardless of the cost in natural resources.

Those of you who attended the Milwaukee meeting of this enforcement conference last March will remember my complaint then that the Federal Water Quality Administration was a paper tiger in the way it confronted, that is, failed to confront the need for a thermal standard. I am in sympathy with the power companies who have been allowed to proceed with the building of their very expensive plants without the guidance of a definitive standard applicable to the whole lake and who are now confronted with the tiger that is somewhat erratically but nevertheless charging at last.

Even so, I am glad the tiger is here. I am even more in sympathy with the public that is still being confronted with the need for a decision without conclusive scientific evidence and with conflicting and contradictory assertions about the issues from scientists and other technical consultants whose appearance here is financed by vested interests seeking a standard that will impose as little restriction as possible on their activities.

In speaking here I have three purposes: One is to point out some of the contradictions and unresolved issues that have been raised in the previous days of this conference, and the second is to make available some pertinent expert knowledge from independent sources in the public interest. Finally, following these independent presentations I wish to make a proposal for an alternative means of achieving protection of the lake from thermal pollution which, if accepted by the power companies, might indeed make it possible to have our power and keep our lake safe, too.

1. The first question I would like to raise is whether there is any contradiction in arguing that the power companies only wish to produce electricity as cheaply as possible in terms of direct costs for the benefit of a public that is presumed to consider electricity

paramount in maintenance of "the good life," and then denying that public's right to question this purpose by terming it hysterical. Surely neither Dr. Edward Raney, in his professed regard for human ecology (undefined), nor Mr. Brandt of Consumers Power Company, in his labeling of an unconvinced public as hysterical, would deny that it is the public, one way or another, that will ultimately pay the cost of whatever decision is made by this conference.

I submit that the first duty of this conference, the Department of Interior and the power companies is to carry out the public's desire. As a member of the public, I applaud the Department of Interior for acknowledging that I would prefer to pay a bit more for my electricity each month to make certain that my lake remains free of thermal pollution. I trust that those who would use the lake to produce power would not deny that it is my lake and my neighbor's lake and that of my fellow citizens in Illinois, Indiana, Michigan, and Wisconsin rather than the property of corporate interests whether they produce power, steel or paper pulp. This brings me to my next question.

2. All the discussion by scientists representing utility interests this week has concerned demonstrating that no damage would be done to the lake in terms of its present condition, as if that condition were satisfactory for all

purposes, except for a few complaints that thermal discharges were receiving unfair attention when other sources of pollution are more culpable. I would point out that the members of the public who are most concerned with avoiding all possibility of thermal pollution are for the most part the same persons who would seek to correct the damage being done by other means, such as overloading with sewage, chemical wastes and so forth. Further, I would point out that our concern with the condition of the lake has been generated not by our fellow, if you will, hysterical citizens but by your fellow scientists and technical experts.

Here in this very conference we have heard a report from Jacob Dumelle suggesting that the quantity of phosphates in the lake has been greatly underestimated.

Repeatedly in public hearings and on other occasions ever since the Stoermer-Yang report on "Plankton Diatom Assemblages in Lake Michigan" was released last spring, I have cited their conclusions in explaining my own fears about the future of the lake. As I said before the Illinois Board last week, Stoermer and Yang state that the changes that have already occurred in the population of planktonic plants and animals indicates that the decisions made in the next 10 years or less will determine whether the life now in Lake Michigan will become more like the present life in Lake Erie.

Mrs. L. Botts

I have never heard this conclusion refuted. Indeed I have never heard any part of the Stoermer-Yang study disputed, unlike the controversies that have raged around some of the scientific reports made by consultants to the power companies. Not only lay members of the public but other scientists, some of whom fortunately have undertaken to interpret the situation for the public, are worried. I would like to read briefly from an article prepared by Dr. William Beecher, director of the Chicago Academy of Sciences and member of the Open Lands Board, for the new publication "Illinois Environment." The title is "An Ecologist Looks at Water," and he says:

"I saw Lake Erie the year before it died. With Dr. Paul Ehrlich and Dr. Joseph Camin, both then on my staff, I visited Middle Island to collect for an experiment on miteborne diseases a quantity of the watersnakes that live on that limestone island .... At Middle Island more than once we saw the big snakes swimming in from the open lake with mud-puppies in their mouths, the amphibians known to comparative anatomy students as Necturus. It was a minor part of the food chain. I relate this because the following year the snakes were not there. The mud-puppies had died off, mayflies had ceased to hatch and the whole food-chain of western Lake Erie had collapsed. The end had come with stunning suddenness -- and all we had noted was an unusually large amount of algae along the shores and in the small bays!

"Of course it could happen to Lake Michigan! The clear, cold waters, teeming with splendid fish, noted by Marquette and Joliet, are already clouded by the algal slime that betrays a last-ditch attempt of the ecosystem to replenish the oxygen used up by bacteria in combatting pollution. ...

"Lake Michigan has two basins, separated by a high ridge that runs between Milwaukee, Wisconsin, and Grand Haven, Michigan. The longshore currents come down the west shore past Chicago and then tend to swirl around in the toe of the lake, trapped by the ridge. Sediments produced and deposited by industry in this lower or southern lake basin tend to accumulate on the bottom, perhaps to be periodically brought into the surface waters in the spring and fall overturns of the lake, due to warming and cooling of the top layers. In the fall of 1964 this may have happened. I announced that Lake Michigan had become a killer lake when several of us found 10,000 gulls and 2,500 loons dead on the Illinois, Indiana, and Michigan shores. The cause of the deaths of these very tough birds was never determined but the mayflies have ceased to hatch out of Lake Michigan, and last year there was a die-off of mud-puppies, some picked up on Oak Street beach. The warning flags are up and I remember how quickly Lake Erie turned the corner! But Lake Erie is part of a broad river of lakes and can be cleaned up by flow-through once pollution stops. Lake Michigan is a cul-de-sac and the canal would be ineffective in saving its life if it turns for the worse."

It is unfortuante for the utilities, but the fact remains that they seek to use a lake that already needs restoration in large areas, which brings me to my third point.

3. Repeatedly testimony has been given this week that damage to water quality by existing thermal plumes cannot be demonstrated, with the Waukegan plume most frequently cited. My question has to do with the fact that this discussion has been in terms of the present condition of the lake in that area where relatively little life as evidenced by fish or other biological signs can be found, apparently either inside the plume or outside it. No one has attempted to assess the possible past role of heat in relation, say, to the input from the North Shore Sanitary District in bringing the lake to its present state there.

When I have asked whether anyone has compared the present ecological state to a previous one, I have been told there is no baseline data available from, say, 25 or 45 years ago or longer. All I know is that formerly there was a much greater commercial fishery out of Waukegan Harbor than now and that this past summer almost all of the beaches in the area were closed to the public as unsafe. It is contradictory to say that the future effects of heat will be studied without attempting to assess its possible past role.

My fourth point also has to do with difficulties of field studies.

4. I have heard many references this week to the difficulty of making judgments based on laboratory findings without field experiences to confirm them. I have also heard this week Dr. Donald Pritchard's descriptions of possible diffusion systems based on calculations derived from mathematical modeling and the assertion that Dr. Pritchard has proved that with a properly designed diffusion system based on results of his calculations only a small fraction of the lake's area will be affected by thermal discharges from the nuclear plants.

Is it not contradictory to reject some laboratory findings of potential thermal pollution and accept Dr. Pritchard's mathematical proofs of protection for most of the lake with his mathematically-tested diffusion system? And, considering the public ownership of the lake already discussed above, who will have the authority to impound even the very small areas Dr. Pritchard says will be needed, 99 acres at Zion possibly, provided his calculations are substantiated in application? Finally, when and how will actual field tests be made of the system he proposes, to determine whether, in fact, it is mechanically feasible and the required engineering is achievable in Lake Michigan where it would be needed? In short, is it not contradictory to reject some laboratory predictions and accept others?

I have another quarrel with Dr. Pritchard, which constitutes my next point.

5. Dr. Pritchard asserts that the money required to build cooling towers would be better spent for, for example, sewage treatment plants. Is he suggesting to Commonwealth Edison that the money this company would have to spend at Zion to avoid discharge of heat be made available to the North Shore Sanitary District already mentioned? Certainly the need is there, and if this kind of tradeoff -- a term I learned in studying power production issues -- is possible, then I believe the public might find it worth considering.

Unfortunately, our past experience leads to believe that the money Commonwealth Edison saves by not building cooling towers will be put to use by the company for its own purposes unless, as already has happened in Illinois, some public body like the Illinois Commerce Commission directs otherwise. I am among those who regrets that we do not have a public body with the power to give such directives in the present case, and remain convinced that a strict thermal standard is the only means available to protect the lake.

Still another question has been raised by Dr. Pritchard's presentation.

6. If Dr. Pritchard's recommendation for a discharge system proves reliable, then how will the public be assured that the best possible system will be used on all nuclear plants discharging into the lake? I am submitting to you with this statement an updated fact sheet on the existing and proposed Lake Michigan nuclear plants on which the variations in discharge systems is apparent.

The only instance in which a design of a discharge structure has been substantially changed to my knowledge is at the Donald C. Cook plant near Bridgman, Michigan, where the point of discharge was moved from 150 feet offshore to 1,200 feet. There the change resulted from public protest to the Corps of Engineers about possible erosion damage, not from the company's concern with Lake Michigan.

Indeed, it is the Corps of Engineers that grants permits to build discharge structures, and under its new policy of implementation of the National Policy Act, presumably applications for any new plants would be submitted to the Department of Interior and FWQA for review. But what about these five plants where the discharge structures are already under construction or are already completed? Under what authority will they be required to make changes? The Corps of Engineers has observors here, but is not participating. Are we to assume that the power companies will voluntarily initiate needed action?

I became interested in the methods of discharge myself when I observed about a year ago that at the Point Beach plant in Wisconsin the cooling water would be discharged at the shore on the surface, in accordance with the theory that Dr. John Ayers espouses about the means for achieving most rapid dispersal of the heat into the water. Yet I knew that at Zion the discharge would be diffused 700 feet offshore under water in accordance with the theory now advanced by Dr. Pritchard. When I asked the representative from the Wisconsin Power and Electric Company about the difference, especially since the plants are both on the same side of the lake although 200 miles or so apart, and had been built by the same company, Sargent-Lundy, he talked for 10 minutes and then said, "I guess I haven't answered your question, and I have to say we don't know, that we are proceeding according to our best judgment."

Well, I will have to say that I think it is contradictory to reject the right of the Department of Interior to proceed according to its best judgment and still retain the right to proceed in that fashion as the prerogative of power companies. This discussion of the possible need for change in plant design brings me to the next point.

7. Is it not contradictory to assert the impossibility and the economic hardship involved in changing plant design during construction but before the plant is being operated, and yet to assert that it will be feasible and the power companies are willing to suffer the financial loss involved in adding cooling facilities later, provided, of course, it becomes necessary owing to proved damage to the lake? This leads me to yet another question.

8. How and by whom will the damage be determined? By consultants to the power companies? I am afraid that will be unacceptable to those concerned about the possibility of damage. By the State agencies? But we are already confronted with the difficulty of separating the interests of at least some State agencies and the power companies. By the Federal Water Quality Administration? I suppose the outcome of this conference will indicate whether and the extent to which the paper tiger has indeed changed its stripes. This question of authority to make assessments

brings me to point number nine.

9. We have heard this week of Dr. Edward Raney's conclusion that with judicious placement, a large number of nuclear plants could be operated on the shores of the lake without danger, yet Dr. Raney did not tell us his criteria for judging the sites nor who would do the judging for future sites much less who will review the existing sites. That brings us back to the question of whether the power companies will agree to change existing sites if they prove unwise, and I am afraid the answer is obvious.

One specific criterion has been mentioned this week and that is that thermal discharge plumes should not overlap. In one existing case on the lake it has always been a matter of concern to the conservationists that the relationships of the Point Beach and Kewaunee plants only 5 miles apart on the same bay have not been assessed. Who will determine now whether their plumes will overlap and assure us that something will be done about it if they do? The question of assurance brings me to point number ten.

10. Mr. Kopper of the Indiana and Michigan Power Company spoke of his company's assurance that no injury will befall Lake Michigan and of their efforts not to intrude on the environment through use of paint of a particular color and proper design of the building.

Unfortunately for the public's peace of mind, this is the company that installed a coffer dam that started an erosion process the company's own geological consultant, Dr. Jack Hough of the University of Michigan, said in an open hearing would extend 20 miles down the shoreline unless stopped. Still more unfortunately for those particular members of the public whose property was directly affected, they had to resort to a lawsuit to secure replenishment of sand on their beaches.

I believe one of those property owners is present today and I will leave it to him to tell you whether he thinks sand-colored paint and low-lying buildings provide adequate environmental protection at the Donald C. Cook site.

11. My last point in this series concerns a most fundamental assertion that has been made repeatedly by various spokesmen this week, and that is the statement that the addition of heat from the nuclear plants might prove, or some say would prove, beneficial to the lake. Exactly what is meant by beneficial has not been clearly defined.

If it means that there will be even less trout and salmon and more carp, I question how many members of the public will agree, even if they can catch carp all winter near powerplant outfalls.

If it means an increase in total biomass, as asserted by Dr. Mary McWhinnie before the Illinois Board last week, how does this equate with a denial that the additional heat will accelerate eutrophication, when the first stage of advancing eutrophication is just such an increase in the total quantity of living matter in a body of water?

Another suggestion has been made by Dr. Fred Lee that addition of heat to the water might increase its capacity to deal with pollution by increasing the rate of chemical reactions. Apart from the fact that I am confused as to how this increase is going to take place if Dr. Pritchard is correct, shouldn't it be possible to confirm this assertion by the finding of improved water quality near existing outfalls? Yet we are told there is no discernible difference within a plume and outside it.

In conclusion of this part of my statement, I believe it must be obvious by now that at least as many if not more questions have been raised for me by this week's workshop as have been answered concerning thermal discharges and Lake Michigan. In view of all the contradictory assertions, is it wonder the public is confused if not hysterical?

There is one point on which I find myself in agreement with the power companies and their consultants who have appeared this week, as well as Dr. Philip Gustafson of Argonne National Laboratory and others, and that is on the lack of information about existing thermal discharges.

It has seemed to me that not only are more facts needed about effects of existing powerplants but that we also need the judgment of independent scientists who are qualified to advise us to their opinion about the probable long-term results of using Lake Michigan for seven or more large nuclear plants. Finally, I believe that for the public to make its decision about its willingness to bear the greater direct costs engendered, by avoiding use of the lake as a heat sink, advice is also needed by independent experts about the cost of using cooling devices relative to the benefits obtained. Thus I am happy to be able to introduce two sources of independent information.

The first is Miss Edith McKee, a consulting geologist, who has interrupted an almost completed study of Traverse Bay to describe here the effects she has observed of operation of the Big Rock Point nuclear plant there. Her background and qualifications will be described by Lowell Gomes, a member of the consulting firm with which Miss McKee is associated.

The second is Dr. John Bardach, a distinguished aquatic biologist of the University of Michigan, who has come from Ann Arbor to serve as a consultant to the public.

A third person, Dr. John Langum, an economist, who had intended to make a presentation on the costs of cooling devices relative to the means of the companies to provide them, has had to go out of town to attend a funeral. His presentation will be filed with you as soon as he returns.

I have been supplied with an abstract of an article by Dr. Beeton from the University of Wisconsin, and copies have been given to the conferees. Dr. Beeton sent this material at our request because of the points that had been raised during this week on whether there was any difference between the inshore and offshore waters of the lake, and I will read a one-paragraph abstract of the same. (See Pp. 1812a-1812f)

"Significance to the eutrophication problem of inshore-offshore differences in nutrients and the planktonic diatoms of Lake Michigan.

"Many engineering studies dealing with water supply, disposal of sewage, waste heat, and industrial waste have been based upon the assumption that the entire volume of Lake Michigan was available for dispersion and dilution of the pollutants. Recent studies have indicated, however, that inshore waters in most areas of the lake proper have different concentrations of phosphorus, nitrogen, and

1812a

SUBMISSION OF PAPER

AMERICAN SOCIETY OF LIMNOLOGY AND OCEANOGRAPHY, INC.
33rd Annual Meeting
University of Rhode Island

August 26 - 29, 1970

NAME Beeton (Last) Ruth (First) Holland (Initial)

CO-AUTHORS (if appropriate) A. M. Beeton

ORGANIZATION Center for Great Lakes Studies, University of Wisconsin-Milwaukee

ADDRESS Milwaukee, Wisconsin 53201

TITLE OF PAPER: Significance to the eutrophication problem of inshore-offshore differences in nutrients and the planktonic diatoms of Lake Michigan.

ABSTRACT (Approximately 200 informative words. Use attached sheet if necessary):

Many engineering studies dealing with water supply, disposal of sewage, waste heat, and industrial waste have been based upon the assumption that the entire volume of Lake Michigan was available for dispersion and dilution of the pollutants. Recent studies have indicated, however, that inshore waters in most areas of the lake proper have different concentrations of phosphorus, nitrogen and silica from offshore areas. These inshore and offshore differences in the distribution and concentration of nutrients are reflected in the distribution and abundance of planktonic diatoms and in the species composition of the Melosiras. The present study was undertaken to further document inshore and offshore differences. Samples were obtained by car ferry on a transect which ran across Lake Michigan and Green Bay from Frankfort, Michigan, to Menominee, Wisconsin. The new data substantiated earlier findings, and indicated in addition that there were differences between inshore and offshore waters in Green Bay.

Suggested Division:

✓ 1) Environmental Enrichment
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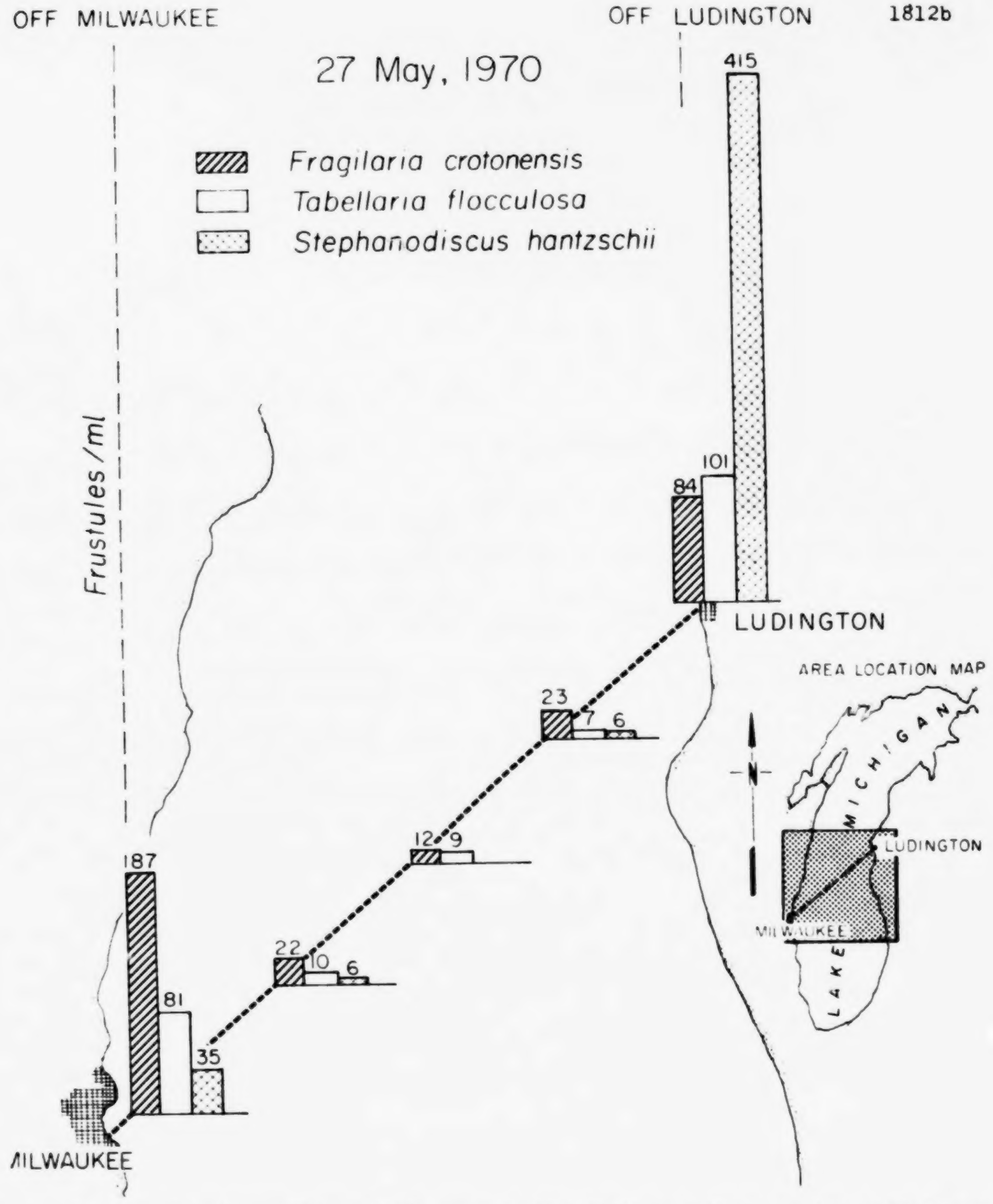

Fig. 1. Example of inshore-offshore differences in distribution of three species of diatoms in Lake Michigan. Inshore samples were taken 3 miles off Ludington and Milwaukee, offshore sampling locations were greater than 10 miles from shore (from paper by R. Holland Beeton and A.M. Beeton, presented at 33rd annual meeting of the American Society of Limnology & Oceanography, Kingston, R.I., Aug. 1970)

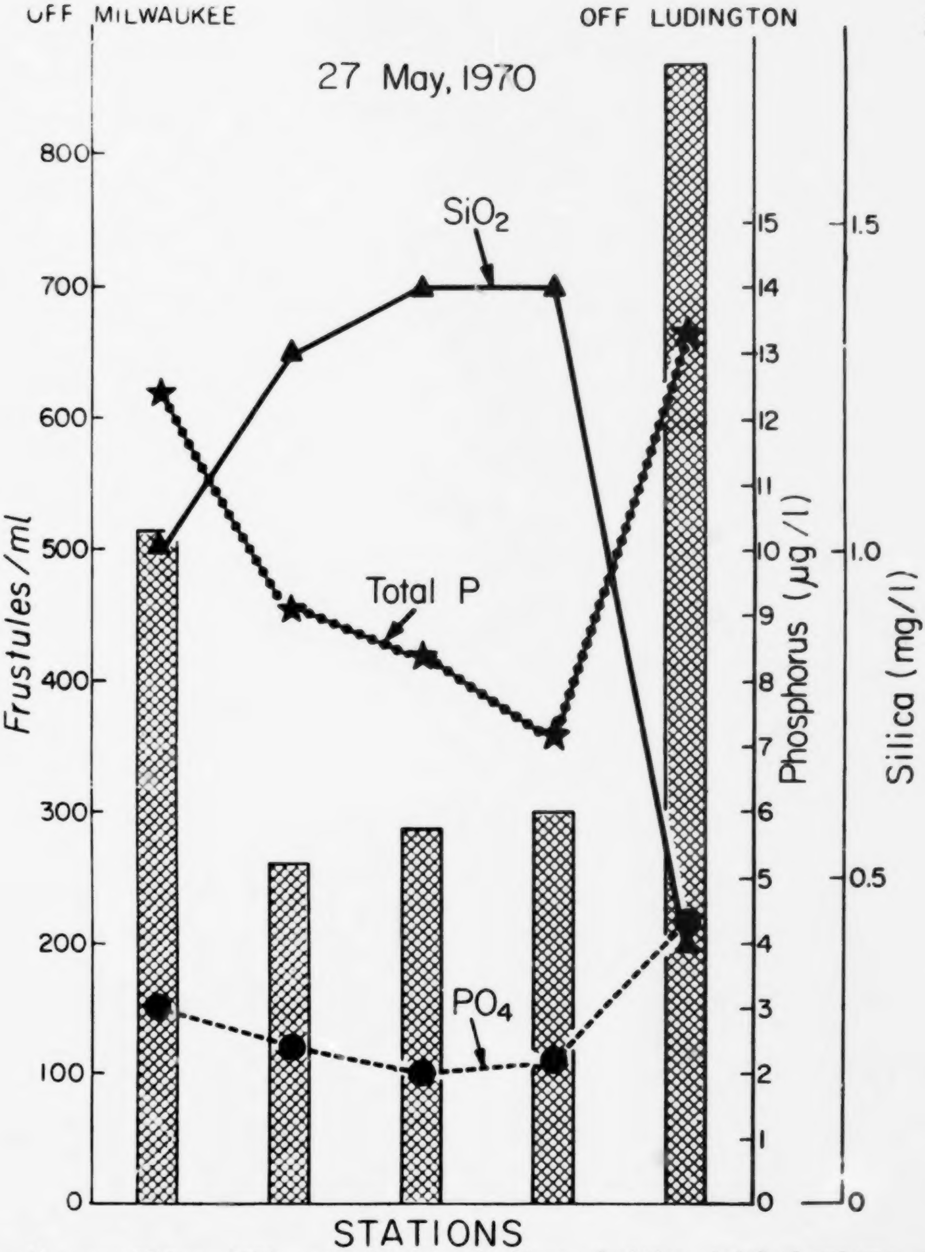

Fig. 2. Inshore-offshore differences in concentrations of silica, total phosphorus and nonparticulate phosphorus (PO_4) at the same sampling locations as in Fig. 1 (from paper by R. Holland Beeton and A. M. Beeton, presented at 33rd annual meeting of the American Society of Limnology and Oceanography, Kingston, R.I., Aug. 1970)

1812d

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CORRELATION OF *MELOSIRA* SPECIES WITH TROPHIC CONDITIONS IN LAKE MICHIGAN[1]

Certain species of the diatom genus *Melosira* have been associated with different trophic conditions, that is, the degree of available nutrient supply. Hustedt (1945) has called *Melosira granulata* (Ehr.) Ralfs the planktonic diatom most characteristic of eutrophic waters in Europe. *Melosira granulata* and, to a less marked extent, *Melosira ambigua* (Grun.) O. Müller characterize strongly eutrophic bodies of water in Britain (Lund 1962*a*). *Melosira binderana* Kütz. has become one of the predominant diatom species in western Lake Erie in the past 30 years (Hohn 1968), while the waters of Lake Erie have undergone accelerated eutrophication during the same time (Beeton, in press). *Melosira islandica* O. Müller is the dominant diatom in Great Slave Lake, which is considered oligotrophic (Rawson 1956; Lund 1962*b*). The distribution of these species in certain regions of Lake Michigan appears also to be correlated with trophic conditions.

METHOD

A Van Dorn sampler was used to collect 219 samples at 2, 5, and 10 m from five regions in Lake Michigan and southern Green Bay (Holland, in prep.). The diatoms were cleaned with nitric acid. After most of the acid had boiled off, the mixture was diluted and passed through a 0.45-μ membrane filter. Diatoms were examined at 970× under phase contrast from a portion of dried filter made transparent with immersion oil. Each complete valve was counted as one-half diatom frustule.

DISTRIBUTION OF *MELOSIRA* SPECIES

The species association in southern Green Bay was markedly different from those of the regions sampled in Lake Michigan itself (Fig. 1). The flora of Green Bay was characterized by species that have been associated with eutrophic conditions: large numbers of *M. granulata* and secondarily, *M. ambigua* and *M. binderana*. Although *M. islandica* occurred only occasionally in the waters of Green Bay, this species was the dominant form in Lake Michigan near the western shore and in the open lake areas. It was a codominant with *M. ambigua* near the eastern shore. *Melosira granulata* and *M. binderana* were seldom found in the lake.

COLLATERAL DATA

Collateral data from the five sampling areas provide a comparison of relative trophic differences. Average diatom concentrations were higher in Green Bay than in the lake (Table 1). Diatoms were more abundant in the nearshore areas of the lake than in the offshore areas, but numbers were about one-third greater at inshore Michigan than at inshore Wisconsin.

Total and particulate phosphorus were considerably higher in Green Bay than in the lake, while average nitrate-N levels in the bay were almost three times lower (Table 1), and at times were not detectable (Allen 1966). Presumably most of the nitrogen was tied up in the plankton and little remained as nitrate. Beeton (in press) has established that southern Green Bay is a eutrophic area. Average values for total and particulate phosphorus near the Michigan shore were much lower than those in Green Bay, but were higher than those of the other areas of the lake. Nitrate-N levels in waters of inshore Michigan were higher than those in Green Bay but lower than nitrate-N levels in other areas of the lake.

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[1] Contribution No. 10, Center for Great Lakes Studies, University of Wisconsin-Milwaukee.

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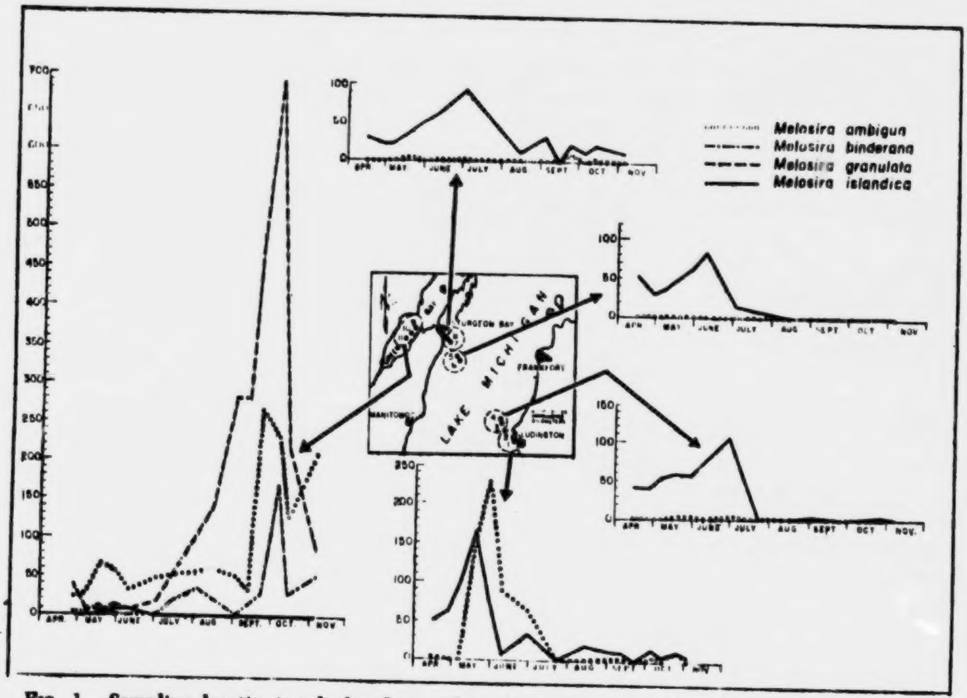

FIG. 1. Sampling locations and abundance of predominant species of *Melosira* (frustules/ml) in southern Green Bay and Lake Michigan, April into November 1965.

TABLE 1. *Average concentrations of phosphorus, nitrate, and total diatoms, April into November 1965, and cell volume and total biomass (in parentheses) of predominant species of* Melosira *at times of peak abundance in southern Green Bay and Lake Michigan. (Values of phosphorus and nitrate in ppb from Allen 1966; diatoms in frustules/ml; cell volume in* μ^3*; total species biomass in* μ^3*/ml. A = absent or uncommon)*

	Inshore Michigan	Offshore Michigan	Offshore Wisconsin	Inshore Wisconsin	Green Bay
Total P	9.3	6.5	6.0	6.2	33.0
Dissolved P	3.6	2.8	2.4	2.4	7.0
Particulate P	5.5	3.9	3.3	4.0	26.3
Nitrate-N	100	113	112	109	37
Diatoms	813	390	350	514	944
M. ambigua	2.9×10^3 (0.7×10^6)	A	A	A	6.1×10^3 (1.6×10^6)
M. binderana	A	A	A	A	23×10^3 (3.8×10^6)
M. granulata	A	A	A	A	24×10^3 (17×10^6)
M. islandica	25×10^3 (4.2×10^6)	22×10^3 (2.3×10^6)	21×10^3 (1.7×10^6)	25×10^3 (2.3×10^6)	A

1812f

TROPHIC SIGNIFICANCE

The distribution of species of *Melosira* appears to reflect trophic levels: eutrophic conditions in Green Bay, oligotrophic conditions in offshore waters and waters near the Wisconsin shore of Lake Michigan, and intermediate conditions near the Michigan shore.

The size of the standing crop of *Melosira* in the different areas (Fig. 1) supports the above conclusions. Eutrophication generally favors the development of large numbers of cells as well as the occurrence of large forms or colonies (Findenegg 1965). Although *M. islandica* at times had a greater cell volume than the forms which have been associated with eutrophy, the greater combined numbers of the latter in Green Bay produced a significantly greater total biomass there (Table 1). Thus, the total biomass of *Melosira* was greatest in Green Bay, least along the western shore and in the open lake, and intermediate near the eastern shore.

Nalewajko (1966) reported a similar phenomenon of differences in diatom species among regions in Lake Ontario. *Melosira islandica* was a predominant species of the central lake, while *Stephanodiscus tenuis* predominated in coastal areas, suggesting differences in trophic levels between inshore and offshore waters.

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[2] Mrs. Alfred M. Beeton.

silica from offshore areas. These inshore and offshore differences in the distribution and concentration of nutrients are reflected in the distribution and abundance of planktonic diatoms and in the species composition of the Melosiras. The present study was undertaken to further document inshore and offshore differences. Samples were obtained by car ferry on a transect which ran across Lake Michigan and Green Bay from Frankfort, Michigan, to Menominee, Wisconsin. The new data substantiated earlier findings, and indicated in addition that there were differences between inshore and offshore waters in Green Bay."

We are grateful to Dr. Beeton for making this information available to the public interest.

Now, I would like to introduce Dr. Gomes, who will introduce Miss McKee, who has slides and materials relative to her findings in Little Traverse Bay.

Then, with your permission, I would like to read into the record Dr. Bardach's recommendation, a statement he made regarding the potential for heat input to Lake Michigan and Dr. Bardach himself is present to answer questions about his statement.

Mr. Gomes.

STATEMENT OF LOWELL GOMES, SENIOR ASSOCIATE, THEODORE S. LEVITON & ASSOCIATES, CHICAGO, ILLINOIS

MR. GOMES: I am Lowell Gomes. I am a Senior Associate with the firm of Theodore S. Leviton & Associates, at 208 South LaSalle Street, Chicago. One of my projects has been to coordinate our firm's various research efforts concerning Lake Michigan and the other Great Lakes, and I am here to present my firm's general viewpoint on the thermal standard question. Miss Edith McKee, our Chief Geologist, will present the specific findings to date, following my presentation.

We are in favor of a responsibly moderate approach to this problem. We realize that the importance of keeping the lake as an unspoiled natural resource must be balanced with the necessity of increased power generation by non-fossil fuel means, both to ensure adequate power and to reduce air pollution.

We maintain that, because of the exigencies of the situation, we must take a very practical approach: one that utilizes to the fullest any existing hard information on the lake from whatever source obtainable. It would be nice if we had great amounts of scientifically exact data stretching back decades, covering all parameters measuring lake quality. We don't have this data, at least for the most part. But this does not mean that no information exists; rather it indicates that we must look more deeply and more broadly than we have.

Our research shows that it is grossly misleading to speak of the lake as a whole; it is only slightly less deceiving to divide the lake up into "the open lake" and "the inshore lake." We maintain that the ecological and environmental effects of discharging heated water at any particular site can be accurately assessed only by complete study of the site in question. It is dangerous to attach unmerited significance to results of isolated laboratory study or to conclude with any degree of finality from one or two studies of existing thermal intrusions that such interference is not dangerous to the lake. Models and laboratory studies eliminate many variables that exist in nature; studies conducted at other sites are bound to involve variances which may make the conclusions inapplicable to other sites.

Cross-disciplinary efforts are necessary to help eliminate the effects of insufficient data and of conclusions based on studies which exclude important parameters. We have attempted to do this by taking a hard geological look at the whole lake in general, and at Little Traverse Bay in particular.

There has been considerable testimony on biological, biochemical and meteorological aspects of the thermal problem, but very little has been mentioned of the geological impact, a gap we will attempt to plug. Beyond this, we have interviewed responsible long-time residents of the Little Traverse Bay area and have questioned them concerning changes they have noticed. While a beach-side resident may not be a qualified biologist, he certainly is competent to observe when the water washing up on his land was clean, when he first noticed significant algae growth, or when he no longer was able to see the bottom. With no conclusive historical scientific data in this area, we cannot ignore this sort of observation without violating our responsibilities to preserve the lake as a natural resource.

Our research on the lake generally, and on Little Traverse Bay in particular, enables us to reach some tentative conclusions which lead to the following recommendations:

1. That 1-year studies of any heated discharges are not sufficient to detect significant trends, even locally, that will predict long-term effects on the quality

of the lake.

2. That it is not prudent to assume that we can permit heated discharges to approach the projected 1980 levels, without risk of serious effects.

3. That the number of powerplants allowed to use lake water for once-through cooling must be severely limited until long-term studies are completed on existing plants.

4. That long-term or perhaps perpetual studies are needed at each site to monitor and determine effects of thermal discharge on the ecology and the environment. These studies should be made by governmental and other agencies as well as by the power companies.

5. That such studies should be cross-disciplinary and that they should be of a scope and depth which will allow the gathering of data from all available sources.

6. That more extensive work in several scientific disciplines, including lake geology, should be incorporated into site location studies and planning.

7. That any harmful effects of thermal discharges may be significantly lessened by consideration of geological factors. This would be primarily of use before site construction.

8. That a 1-, 3-, or 5-degree temperature

standard would not necessarily be sufficient to protect the lake, as well as presenting enforcement problems.

9. That the standards pertinent now are necessarily qualitative rather than quantitative; thus the laws promulgating these standards should be framed to implement this idea of quality-oriented standards. The measured effects must be legally interpreted in each case.

10. That if new powerplants are allowed to come onstream, they may do so only with the written and legally enforceable understanding that they may be required to alter or terminate their usage of lake water for once-through cooling if sufficient harmful effects are detected.

The specific research on the lake in general and Little Traverse Bay in particular will be presented by Edith M. McKee, Certified Professional Geologist, and the Chief Geologist with Leviton & Associates. Miss McKee has an unique, varied and in-depth knowledge of Lake Michigan gained over 27 years of professional and personal experience with the lake that gives her a valuable overview of scientific knowledge tempered with great personal involvement. A background brief is attached to the outline of her presentation. I would add here that her presentation is printed only in outline form due to the shortage of time available to formulate this information; Miss McKee only returned from her research at Little Traverse Bay this Tuesday. Although the Little Traverse Bay study is not finished, several new factors will be presented from the study that previously have not been adequately considered.

Miss McKee.

STATEMENT OF EDITH M. McKEE, CHIEF
GEOLOGIST, THEODORE S. LEVITON &
ASSOCIATES, CHICAGO, ILLINOIS

MISS McKEE: I am Edith M. McKee. I am a geologist with 27 years of diversified professional experience with the U.S.G.S. and industry in inshore and offshore, surface and subsurface exploration and development programs in the United States and foreign areas.

Since 1958, I have worked as a consulting geologist, currently acting as chief geologist for Leviton & Associates of Chicago. The Illinois Geological Society has certified me as a qualified professional geologist. The American Institute of Professional Geologists has awarded me the title of certified professional geologist, based on detailed examination of academic training, specialized training, geological experience, and ethical conduct.

My area of special interest is the integrated mapping of surface and subsurface geological structures, tectonics, stratigraphy, geomorphology, and paleogeomorphology as they relate to mineral accumulations and land use. Water is a mineral and an erosional depositional force and within the geological area of concern.

The Chicago area has been my family base for several generations. Since the 1890's, family vacations have been spent in Bay View, Michigan, located on Little Traverse Bay at the far northern end of Lake Michigan. Petoskey, on this large map at the head of the room, is located on Little Traverse Bay. Bay View is one mile east -- a short walk.

While not a member of the 1890 vacationers, I have had a long established interest in the entire lake. Since 1932, however, I have been intimately familiar with the waters of Little Traverse Bay as a distance swimmer, boater, fisherman, and summer resident. Since 1938, I have known the Little Traverse Bay shores, basin, and waters as a trained geologist. Except for the summers of 1947, when I was working for Shell Oil in Texas, and 1950, 1952, and 1953, when I was working for Aramco in Saudi Arabia, I have been able to visit Little Traverse Bay for at least short periods each year since 1932.

Since 1967, I have been engaged in an ongoing program to map in detail the bottom terrain and associated

E. M. McKee

geology of the Great Lakes. Lake Michigan was the first lake study. This summer has been spent studying Little Traverse Bay and the north basin of Lake Michigan. Indeed I was called off the U.S. lake survey's research vessel, Shenahen, this week to attend this meeting and will have to complete the survey late this month as the snow falls out there along with the temperatures.

Water quality -- last Saturday I was out, we got two stations and had to come back in. We were standing on our ears. Sleet was coming down at the same time. Water quality, currents, ecological and geological data obtained since June 1970 are relevant to the thermal pollution concerns of this meeting. In fact, I feel a little bit of an outsider having visited and worked with the site of the only nuclear plant operating on Lake Michigan.

The only place in Lake Michigan where the effects of the thermal plume from a nuclear powerplant can be studied is Little Traverse Bay at the far north end of the lake. The Big Rock nuclear plant is located northeast of Charlevoix on Big Rock Point which makes an abrupt eastward trend of the shoreline to form the southern shore of Little Traverse Bay. This bay extends eastward for 14 miles.

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East-flowing surface currents carry the thermal plume from the Big Rock nuclear plant along the south shore toward the head of the bay.

There has been an unfortunate attitude that Little Traverse Bay is too small and the water is too cold to afford critical data concerning lake circulation and water quality. This is not a valid assumption.

Both Little Traverse Bay and the south basin of Lake Michigan are partially enclosed basins with considerable topographic relief and similar geologic formations. Both have well established currents throughout the water column going at different directions. Both are scheduled to receive slightly more than one and a half million gallons of heated water for each square mile of surface water every day from nuclear powerplants.

Little Traverse Bay has been receiving this heat input since 1963, and negative changes in the water quality appear to be accelerating since 1964.

Now, to get down to the presentation of the geological materials developed since 1967 and including the work done this summer, we will start the slides here and I will quickly talk, trying to go as fast as possible here.

When I took these pictures to Earth Day programs

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at a number of high schools in this area, the question was always asked: How many years ago did you take a picture like that? The water at the north end of the lake is still blue on a bright summer day. Inshore it is cloudy. There is algae beginning to come in, but you can still see the beautiful picture.

If you would please run these through -- apparently this isn't working -- if you would please run these though at a steady rate of about a second per -- this is the offshore picture.

Now, this series of maps is called paleogeomorphic. It shows the entire development of the Great Lakes region. This is part of the 1967 study that covers 600 million years of development of the Great Lakes area. Each one of the maps in this series extends from north of Lake Superior to south of Tennessee; from Iowa to the eastern seaboard, New Jersey.

How do we put these together? We still have today in the world active volcanoes pouring out lavas. This is a picture of a lava field in the Belgian Congo.

This is a recent crater in the Philippine Islands. We can go to places -- geologists can -- and know what happened even that long ago.

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The waters came and the waters went. For most of this time, this part of the new continent has been covered by a shallow warm salt sea.

This is in the Persian Gulf where we have sand spits built up. The same thing we can find in the subsurface now in this area.

Gradually the Michigan Basin, of which most of the lakes except Superior are evolved, was surrounded by the coral.

As they go through, you can see there is a change in the water -- I mean the sea and land relationships. Gradually the seas drained off. We had enormous rapid chemical erosion, physical erosion, because there were no plants on the land surface. We have the same thing today in the desert areas in the middle east.

This series is taken over in Saudi Arabia, but it is the same type of terrain which I can map in the subsurface, and all of these have importance on the whole economic program, the whole use of this region.

After about 300 million years of this rapid erosion, we had developed a circular pattern with the center of the Michigan Basin about Saginaw. The hard rocks stood up as ridges around the edge; the soft rocks had been eroded. It was at this time that the major basins for the Great Lakes came into existence. It is this type of topography, subaerially eroded, that we are finding in all of the Great Lakes. In many places, it is covered by modern sediments, post glacial sediments. I believe Dr. Collinson talked about that sometime at this meeting.

It was on top of that topography that the glaciers came down. It did not scour the basin.

We will now go on up to the lake again. It is always fun to get offshore. In order to know the lake basin, in order to know the amount of water in the lake basin, you have to know in detail the shape of that basin. There is onshore geology; there is offshore geology.

Now, this is a picture of the bottom of Lake Michigan, which has been developed through this on-going study done in cooperation with Dr. J. L. Hough at the University of Michigan.

The Mid-Lake High is a 200-foot barrier rising from the bottom dividing the north basin from the south basin. The area of the south basin is very much restricted. It goes down to better than 500 feet on the south end but nonetheless it is comparatively small. The Mid-Lake High has a 200-foot vertical cliff on the north side. The darker colors indicate the deeper waters.

As you can see, the deepest hole goes up southwest

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of Frankfort.

This is an enlarged portion of the Mid-Lake High which in the Chicago area is particularly important because this is the big barrier that controls the curents within the south end of the lake and, even as we will see later, controls the surface currents.

And this is up at Bay View. The cliff here is Traverse limestone. It is exactly the same geological formation. It looks exactly the same -- because we had a submarine and went down and looked at it -- as the western cliffs of the Mid-Lake High off Milwaukee. It reacts in the same way.

This is called a fence diagram. It was constructed from the oil well records in Michigan; the water well records in Wisconsin. We had dredged the samples. We knew bedrock outcrops in the bottom of the lake. This is the first time that we have been able to project accurate -- well, with reasonable accuracy -- the geology beneath the lake basin. This is of importance because of the input of ground water at some of the contacts that we will see later.

This is a bedrock geology superimposed on the topography of the lake. We will be interested in the yellow-green, at the moment, which is the Traverse formation, and the blue-green outside of this. Little Traverse is up at the extreme end, just above the legend. It is at about a third across the bay that we have this contact between the yellow-green -- the Detroit River -- and the blue-green. It is along this contact that we have a series of artesian wells input of water 39 to 41 degrees instigating and carrying out year-round west-flowing bottom currents.

We have the same juxtaposition of geological formations off of Milwaukee. We have the Detroit River formation recognized onshore. We have the Traverse formation in the Mid-Lake high. It has not yet been determined if there is ground water input along that to increase the current flow or not.

Back up in the north country again. This is the head of the bay in the sag between these two geological formations. The sand has moved in -- dune sand. It is very permeable. Any building back there where they have had septic tanks, the drainage has been directly into the bay. That is now controlled.

At the far southeast corner of the bay for many years there was a cannery, and I remember that distinctly because, as a swimmer, I would head over towards Harbor Point which was 3-and-a-half miles away, and as I would be swimming along, I would know where the currents were; I would know where I would suddenly be swimming in 70-degree water and suddenly down to 40-degree -- you know that. There is no doubt when you hit it.

This is a picture of Harbor Springs, one of the best natural harbors on the lake. It has been developed along this geological contact between the Traverse and the Detroit River. There are springs in this harbor. It has deep enough water to take -- well -- some of the largest boats that come in.

This is one of the big cement boats that took shelter in there this summer.

Right off Harbor Point, the currents flow eastward into the bay so strongly that they keep the point cut sharply, but there is a bottom current that flows so strongly to the west that it takes out the fishing nets.

All of the weather in Little Traverse Bay comes from the west. There are a few days when it will come from the east, but that is most unusual. You will remember that Big Rock Point is located approximately 14 miles west of where this pier is.

The plume from Big Rock is held quite close to the shore and moves along at a good rate. When we get a storm such as this was a few weeks ago, it stirs up the bottom, but it also tears up the algal growth that has come in.

When I knew the bay as, say, just a swimmer, until the early sixties, there was no algal growth on the rocks. There was no algal growth on the bottom. Now, when waves come over on the dock, there is so much vegetation, algae that has been torn up that the dock itself is green. You can rake up the piles of algae.

Just a few years ago, as I say, about 1962, the waters were clear, such as this. You could see down 50 feet very easily.

This summer, only twice have I been able to see the bottom off the Bay View dock. If we had the lights off I think you could see that there is enough algae contained within the shore waves this summer so that it looks like a vegetable soup. This growth of algae has been noted by people familiar with the area, one of them being -- I don't quote everybody that I talked with up there, but I will quote Edison Tanner, who is a real estate salesman up there. He lives directly on the bay about 2 miles west of here toward Petoskey and toward the nuclear plant. He moved there in 1962. At that time, there was no growth on the bottom. In 1969 --

MR. FETTEROLF: Excuse me a moment. Where were these photographs taken?

MISS McKEE: Little Traverse Bay.

MR. FETTEROLF: Where?

MISS McKEE: At Bay View, Michigan. The dock I have been showing is the dock at Bay View, Michigan, which incidentally --

MR. FETTEROLF: Which is downcurrent from Petoskey?

MISS McKEE: That is right. It is east of Petoskey 1 mile. And, incidentally, the dock which is shown on the current U. S. Lake Survey charts went out with a magnificent form in 1927. The current dock at Bay View was built in 1934-1935 and I am not sure if this indicates that -- the Lake Survey and Corps of Engineers have not been in there since -- but if you try to dock at the old dock, you are going to have to go about 20 feet down.

MR. STEIN: May I reiterate that I have at least 37 more speakers listed, and we want to hear everyone. So I ask you and everyone who speaks to recognize time is limited and to give consideration to those people who are waiting to follow you.

MISS McKEE: I will try to go as quickly as possible.

This summer, I have been gathering information -- I have seen the water quality -- as I am a geologist, I am not a biologist -- but this summer, the University of Michigan ship, Inland Seas, has been based at Harbor Springs.

They have had a full series of biological tests they have been making off Nine Mile Point, which is a few miles east of the Big Rock plant. Also the Corps of Engineers Lake Survey research vessel Shenahan has been based at Mackinaw City making a 2-week run around the north end of the lake, making water quality studies. They also have a station off Big Rock and possibly Nine Mile, and it is this ship which is coming into Little Traverse to make my own surveys there.

I have pinpointed where the very cold bottom waters come in through the bay. It climbs naturally out towards the big lake in a westward flowing current naturally. There are compensatory east-flowing mid-depth and surface currents which take the warmth from Big Rock directly along the shore.

Fishermen again.

I will quickly go through a lot of these.

There was, for the first time that has been recorded, actual scientific work going on in the bay this summer.

This, going in with the currents and showing how they follow the bottom topography, ties in with the study of Lake Superior I did last summer.

Here again is the bottom topography. This is why six geological provinces were noted.

Now, this is taken from a drift bottle study made at Marquette University, and the currents which were indicated here followed the topography, the bottom topography very much indeed, very closely. I won't go into how these things are made, but they are very well documented.

We will now come down to the currents in the entire Lake Michigan area. These are the currents without topography. As you will see, there is a division about Milwaukee. These are the bottom currents. These currents have been adopted directly from government reports.

We will now put the same current patterns over the bottom topography. It is easy to see how the Mid-Lake high, the 200-foot barrier, influenced the very bottom currents, the mid-depth currents, and even the surface currents. They are all put together here and they all tend to have a general pattern.

We have our air pollution, and fading away into the sunset, as any good travelogue does, at the moment.

But this is accurate scientific work available in Little Traverse Bay, in other areas. It can be documented -- the changes that have occurred since 1963 -- when the Big Rock plant went into operation.

Thank you.

MR. STEIN: Thank you, Miss McKee.

MR. CURRIE: May I ask a question, Mr. Chairman?

MR. STEIN: Well, I don't know. Mrs. Botts, do you want to handle this? Do you want questions now or after you complete your presentation?

MRS. BOTTS: Mr. Stein, I have spoken to Dr. Bardach, and he is willing to let the public officials -- you told us were waiting to speak -- speak now. He would be glad to do that, and then he would go ahead with his presentation.

As to whether Miss McKee answer questions now or later, it makes no difference to us. I will leave that to you.

MR. STEIN: We will take the questions from Miss McKee.

MR. CURRIE: Miss McKee, have you found any evidence of harm caused by heat inputs in Little Traverse Bay?

MISS McKEE: There has been decided erosion of water quality in Little Traverse Bay.

The visibility has dropped to nil. Most of the summer -- only twice this summer have I been able to see the bottom clearly from the Bay View dock, and it would be only about 12 feet down.

This has been remarked upon by boaters, by fishermen, by long-time residents. There has been one thing about the distinctive qualities of the Big Rock plant put into a chart, I believe prepared by Open Lands -- if I am not in error -- that the Big Rock had the coldest waters of the lake.

This summer I have kept temperature records of Little Traverse Bay June, July, and August, and from July they have been consistently and even up to nine points higher than the temperatures reported here at Chicago. For the first time, this summer the waters got up to 75. As I say, usually up there if the water hits 68 it was good swimming. At 70, it felt too warm; and this year, it was over 70 for the entire month of August. Whether this is due to the plume or not, it hasn't been coordinated in with the biological and water quality studies. But there are indications that there has been definite and accelerating degradation of the water.

MR. CURRIE: I think my problem is, as you recognize, one of causation. There are many areas of the lake in which considerable degradation has occurred, and a number of different parameters of water quality have changed, and I wonder if there is any way that we can move along toward identifying which of the changes is responsible or which group of changes is responsible for the changes we see.

Do you know, for example, that nutrient content of the water is unchanged and the only change has been heat and therefore there is a causal relationship between heat and degradation?

MISS McKEE: The input of sewage effluent has been cut. In 1965, the Bay View summer resort, by order of the government, stopped its own sewage plant and switched into the treatment plant in Petoskey. There have been several other resorts which have done the same thing so that the sewage input has been cut. There has been a comparatively stable population. There are no farms and no, say, kept lawns or parks along the lake that would add to the fertilizer input. The streams are comparatively shallow which go into the lake because of the pitch and slope of the geological formations which are responsible for the bay being where it is. The color of Bear Creek which comes in at Petoskey is a deep brown; that is tannic acid from the cedar swamps, but even that is a very short rate. The only major change that we have been able to recognize since the early sixties in the way of downgrading the water is the heat input.

MR. CURRIE: And you say that phosphate and other nutrient inputs to the bay have been decreasing. Is it also true that phosphate concentrations in the bay itself have been decreasing? I take it that as long as you keep putting any new nutrients in there is a possibility that concentrations will continue to increase even though the rate of input has decreased.

MISS McKEE: That I do not know. I have been working with the geology. I am leaving the water quality up to the Lake Survey people whose job it is.

MR. CURRIE: Do you know whether the water quality problems are worse within the plume from the Big Rock plant than elsewhere in the bay?

MISS McKEE: Unfortunately you caught me with my plume down! That is part of the work which has to be done when I get back up there. As a matter of fact, I was scheduled to be mapping on Tuesday, instead of coming down here.

MR. CURRIE: Does the study that you are undertaking have biologists factored into it?

MISS McKEE: I am told it can tie in with the biological studies done this summer by the University of Michigan, and they had the Inland Seas based at Harbor Springs from May through August.

MR. CURRIE: Thank you very much. I think that this kind of study which you are undertaking is exactly what we need to help us with this kind of very difficult decision.

MISS McKEE: Well, that is one of the big points that we make --that we have to have cross-discipline studies. You can't have it just from the biological, just from the geological, just from industry, just from city point of view.

MR. FETTEROLF: Miss McKee, I too have been very fortunate in having had a great deal of experience in Little Traverse Bay. We had a summer home at Wequetonsing prior to World War II, and it was my intrigue with the water at that time that led me to become a biologist.

Now, I would like to ask you if you have traced the heat input from the Big Rock plant along the shoreline of Lake Michigan?

MISS McKEE: I have taken some temperature readings, but not as complete as it will be after I have had the Shenahan in, which is equipped with electronic equipment of all sorts including the electronic thermograph.

MR. FETTEROLF: What is the draft of that boat, ma'am?

MISS McKEE: The Shenahan, I think, is 4 feet.

MR. FETTEROLF: I hope you will be able to get into shore close enough to measure plume. We have done extensive work in that area both prior to the construction of the plant and after in relation to radiation monitoring, and we have mapped the plume on many occasions. We do not find sensible heat beyond a mile from the plant along the very inshore areas. We do note Cladophora and green algae growing on the rocks occasionally in the area of the plume, but we relate this more to the fact that the plant has an on-site water treatment facility than to the addition of heat.

As far as collecting Cladophora for radiation sampling in the area of Big Rock, we find it extremely difficult and we are forced to go to the spits of land on which the gulls perch and fertilize the lake, and that is the only place we find Cladophora.

Now, I agree entirely that the clarity of the water in Little Traverse Bay has decreased tremendously over the years. I believe that we would relate this to the discharge of treated sewage from Petoskey and from Harbor Springs. Both of these wastewater treatment plants are under order from the Water Resources Commission to cut their phosphate loadings in accordance with this interstate conference's decree.

MISS McKEE: Good. I know both Petoskey and

Harbor Springs are in the throes of putting in new sewer systems to take care of all of the communities, summer and winter, on both sides of the lake. But this is the type of input where the geologists and the biologists and the physical chemists, physicians, etc. should get together and discuss it.

MR. FETTEROLF: I think you would find that long-term temperature records for the bay would be available from the water intakes of the communities around the bay.

MISS McKEE: Good. You are the first one who has known that. I have been asking this summer at every community and nobody has known of any records that have been kept.

MR. STEIN: Are there any further questions of Miss McKee?

Thank you, Miss McKee. I knew you were my kind of biologist-- the kind that would be possibly caught with their plume down! I knew that when I read your bibliography. Anyone who has written an article entitled, "Are All these Dry Holes Necessary" is great!

At this time, we would like to hear from Congressman Mikva.

STATEMENT OF THE HONORABLE ABNER J. MIKVA, U. S. HOUSE OF REPRESENTATIVES

WASHINGTON, D. C.

MR. MIKVA: Mr. Chairman, members of the panel, I would like to strongly urge you to follow the Department of Interior recommendation that "... no significant discharge of waste heat into Lake Michigan should be permitted." The great lake is not and should never be considered an industrial dumping ground.

If there is any single issue before this four-State enforcement conference, it is not whether industry must pay more or less for stopping its pollution but whether, in the future, the lake itself will be used primarily for the profit and exploitation of industry or whether it will remain a great natural resource of the people.

The people who live along its shores will quickly tell you that Lake Michigan is their lake. They swim in it, boat in it, sun bathe on its shores, fish in it, drink its water. At least they used to be able to do all those things. Its presence has given their residential neighborhoods a distinctive quality. If the temperature of the lake rises and the death of the lake accelerates and the salmon leave and the lake trout go away and the beaches become clogged with dead alewives and algae and the bacteria count in the drinking water rise, then the quality of life for the people along its shores will change. A Chicago on the bank of a dead lake is a different Chicago, and probably a dead Chicago.

Our Government must begin to care about the quality of life of its individual citizens as much as it cares about the prosperity of its corporate giants. This conference is a good place for that caring to begin.

Experts have been produced by both sides arguing for or against the damaging effects of heated discharge water on the life of the lake. No definite answers have been found. Commonwealth Edison has argued that heated wastewater will damage plant and marine life but the damage will be minimal. Environmentalists, on the other hand, have argued that heated water discharge from nuclear powerplants will do irreparable injury.

Dr. Wesley O. Pipes, professor of civil engineering and biological sciences at Northwestern University, has informed me that he believes it would be impossible to find any group of scientists qualified to carry out a study of thermal pollution who would also be completely objective about the interpretation of the data due to the present public concern and polarization about water pollution. Last weekend a biologist testifying before the Illinois Pollution Control Board argued that more data on thermal pollution would be needed before "realistic and meaningful limits" could be set on heated water discharges.

When expert confusion abounds in such situations involving the public good and the quality of life, then government agencies should err, if err they must, on the side of the people, and place on polluters the burden of proving beyond any doubt that their discharges will cause no injury. Indeed the watchword ought to be: not in the lake unless you can prove beyond a reasonable doubt that it will not adversely affect the lake.

I am not an expert on the technical aspects of thermal pollution. I represent the interests of the people in my congressional district along the shore of Lake Michigan. Last winter a number of my constituents brought to my attention Commonwealth Edison's questionable use of the Pipes and Beer study of thermal discharge from the utility's Waukegan powerplant. I understand that the study is being referred to in the present controversey. The study, conducted by Wesley O. Pipes and Mr. Lawrence P. Beer, has been labeled by the power company as a preliminary environmental investigation which proved that the Zion Station discharge would have no detrimental effect on the lake, and I suggest that it proved no such thing.

According to Professor Pipes, his study states simply that, "... there is no indication of any deleterious environmental effects due to the Waukegan Station discharge ...." The Waukegan Station, however, is hardly comparable to the Zion Station in both size and power production.

In a letter to me, Professor Pipes disagreed with Commonwealth Edison's use of his study and assured me that it "... does not provide scientific assurances that no harm will be done to Lake Michigan by discharge from Zion Station." It was, he added, "... an extremely short term study."

It is my understanding that the data for the study was gathered on 3 days in April 1968. The man who supervised the gill net catches for the study, Mr. Bruce Munch, Director, Northeast District, Division of Fisheries, Illinois Department of Conservative, has informed me that he believes that any conclusions drawn from the study's gill net catches would have very little ecological significance. I understand from conversations with Mr. Munch that the fish caught in the gill netting were simply attracted to the location by the warm water and that there was no way to determine how long they had been in the heated water or whether it was harmful to them or not.

To a layman like myself, Professor Pipes' and Mr. Munch's reservations about the conclusions drawn from the study by the power company make its current use as a backstopping outrageous. I was sorry to learn that Commonwealth Edison is still referring to it to buttress their argument that the Zion Station discharge will not be harmful. The argument is not true.

The formula that we are dealing with here is very simple. If there is any possibility that heated water discharge will damage the lake then the discharge of heated water must be restricted. Feasible and economically reasonable alternatives such as cooling ponds and towers exist to do so. Unless these alternatives are used, not only will we accelerate the eutrophication of the lake, but we will open the flood gate for the accelerated industrial and commercial exploitation of the lake as well.

A basic policy decision on the use of the lake must be made. Gentlemen, in making that decision, I hope you will keep in mind that in the long run no one will really profit from a dead lake, not even Commonwealth Edison or its power customers.

Hon. A. J. Mikva

Mr. Chairman, I said I make myself feel as though "I saw this picture before."

I am sure this discussion about whether the steel companies should dump their wastes into the lake was like the discussion you hear from some of the new mothers at the present time -- that just because there is no proof as yet that birth control pills will not do any harm, this is not assurance that they will not do any harm. Maybe at the time that U. S. and some of the steel giants built their plants there wasn't any proof. But we have proof now, and it is to the sorrow of all of the people on the lake that there wasn't some far-sighted public officials at that time who said, "Not in the lake unless you can prove it won't do any harm."

Thank you for your time. (Applause)

I would be glad to answer any questions but I suspect I will be caught with more down that the previous speaker! But go ahead.

MR. STEIN: Are there any questions of Congressman Mikva? I guess not. You have been very persuasive.

MR. MIKVA: I hope so.

MR. STEIN: Thank you very much.

May we hear from Attorney General William Scott?

STATEMENT OF WILLIAM J. SCOTT, ATTORNEY GENERAL, STATE OF ILLINOIS, SPRINGFIELD, ILLINOIS

MR. SCOTT: Mr. Chairman, gentlemen. For the most part of this past week, you have been listening to the hired spokesmen of the polluters, the great corporations, the electric companies, the municipalities and others who are using Lake Michigan as a free sewer.

As an attorney general of the State of Illinois, I am here to seek equal time for the people who are the victims of the polluters--the 30 million citizens of the four States that you people represent who are depending on you and have entrusted you with the responsibility of preserving their environment.

Now, during the previous days of testimony, we have heard scientists and representatives tell us in effect that they don't know what is going to happen when they pour billions of gallons of heated water into Lake Michigan. They have said, in effect, give us 4 or 5 years of lenient standards so that we can determine what will happen. They have asked you people who are entrusted with preserving Lake Michigan for the millions of unborn generations to give them 4 or 5 years of using Lake Michigan as a test tube. They further said that if something goes wrong they will pay for it. They have said, in effect, that if something goes wrong we will pay for it; go out and buy a new lake. They have said, in effect, that it is scientifically feasible to recirculate, but it is going to cost millions of dollars. Of course, they have added to it, on top of it,"We have already gone ahead and located some of our plants in places where it may be physically impossible to build cooling towers or to recirculate.

Now, I submit to you that on one side we have private corporations that have been granted a monopoly to sell electricity in a given area. On the other side, we have citizens of your States who have entrusted you with preserving their environment. And the main question before this conference is: Where is the burden of proof going to be? Is the burden of proof going to be on the people that want to use the lake as a free sewer, or is the burden of proof going to be on the citizens that you represent? I submit to you that the answer is fairly obvious -- that if we are going to do our job of representing our constituents that we have to insist on the strictest possible standards; that we have to say, wherever scientifically feasible, that we use the high scientific knowledge available to preserve the environment; that we have to say, wherever there is a question of doubt, the doubt has to be resolved in the benefit of the people that are going to depend on Lake Michigan for their drinking supply, for their recreation. and perhaps for their very health and lives.

So the real question that you have to determine is: Where does the burden of proof fall? Because nobody can tell you what is going to happen when they start recirculating the lake through dozens and perhaps as many as a hundred atomic reactors. Nobody has been able to tell us that. They refer to examples. Congressman Mikva mentioned the thermal pollution from the plant at Waukegan. I submit to you that last summer the public health official for Lake County, Illinois, where the Waukegan plant is located, ordered the closing of every beach in Lake County. Now, we don't know what the cause of that was. We don't know specifically where the major causes were. But we do know that the pollution came from the municipal sewerage; it came from U. S. Steel; it came from Commonwealth Edison; and it came from Abbott Laboratories. The combined factors resulted in the loss of those beaches to the people of that county.

I think that it is very clear that you people have the responsibility of insisting on the highest standards possible. I am hearily in accord with the Federal report which says that there should not be any significant discharge into Lake Michigan. In fact, I think that wherever it is scientifically feasible, the word "significant discharge" should be interpreted to mean none whatsoever.

It is going to cost money; we realize that. But nobody can put a price tag on an aesthetic Lake Michigan. Our tourism, our boating industries, our fishing industries, our recreational industries are all dependent on that lake.

But more than that, the lives of the 30 million people in the four States that have designated you and that pay your salaries to protect their environment are depending on you to set standards that will do that. I am here to urge you that wherever scientifically feasible, you insist that the water be recirculated rather than just utilized as a free sewer.

Thank you. (Applause)

MR. STEIN: Thank you.

Thank you very much for your presentation.

May we go back to Mrs. Botts?

MRS. BOTTS: I would like to say that a statement has been mailed to me. The postal service didn't cooperate in getting it here in time. I will have to submit it into the record later. Dr. Frank Hooper, a biologist at the University of Michigan, will give you his predictions about the possible effects of heat on the future of Lake Michigan.

(The statement of Dr. Frank F. Hooper follows in its entirety.)

Statement of Frank F. Hooper
Professor of Fisheries and Zoology
Regarding thermal inputs into Lake Michigan

My name is Frank F. Hooper; I am a professor in the School of Natural Resources, The University of Michigan. I teach a course in aquatic ecology. My specialty is water quality and limnology and my graduate students and I have made substantial research contributions in this area. Formerly I was employed by the State of Michigan as an aquatic biologist. In this capacity on several occasions I served as a consultant for the Michigan Water Resources Commission regarding pollution problems in the State of Michigan. I have served as an aquatic ecologist for the Atomic Energy Commission and in this position I have advised them on water quality and limnological matters (additional credentials are attached).

I do not favor further licensing of power plants requiring cooling water on Lake Michigan until the appropriate regulatory agency has set limits for the annual and seasonal thermal inputs into this lake. Such limits must be set with the reasonable expectation that they will protect existing fish stocks and invertebrates and that they will preserve existing aesthetic features of this resource.

Limits, standards or criteria used in regulating heat as well as any other pollutant must be set on the basis of the concentration the pollutant ultimately makes in the receiving water and not upon the concentration of the substance or condition (i.e. temperature) in the effluent discharge. Only in this way is it possible for agencies to regulate or protect a resource. There is an abundance of evidence in the history of water pollution control on major river systems which substantiates this principle for regulation and administration of water use.

In the case of heated effluents entering a large lake such as Lake Michigan, limits set upon the temperatures in individual plumes should not be used as a control over thermal effects upon biological systems. Since 2 or more adjacent plumes may merge and form an inshore water mass that retains its identity for considerable periods of time and have serious biological effects, it is essential that limits be set upon total heat input into inshore waters.

Inshore water masses heated by the thermal discharges in the spring may have serious biological effects upon fish spawning, reproduction of invertebrates and upon the growth rate of plankton. Integration of all of these changes in the system may ultimately completely alter food chains so that an entirely different community of animals and plants is produced.

With large thermal discharges algal blooms in the spring and early summer might be anticipated. Environmental perturbations of this sort bring about decreases in diversity of the flora and fauna and lead to high densities of a few species and create nuisances as far as recreational uses are concerned. I would envision that during the spring and early summer months many of the recreational facilities along the shoreline would be jeopardized by the inputs from a number of nuclear installations or other sources of hot water.

Thermal limits should be established for specific sections of Lake Michigan since the shoreline varies widely in its biological characteristics and upon its capacity for production of various species of plants and invertebrates. Standards set in this manner would then allow thermal inputs up to a prescribed maximum at which time further cooling water discharges must be brought to ambient lake temperature. Regulated in this way, it should be possible to avoid adverse ecological changes.

With relatively little effort and using only existing data it should be possible to arrive at useful estimates of thermal limits which should be set for various sections of Lake Michigan shoreline. Although all of the desirable data are not at hand (and may never be) given the best available expertise the regulatory agency can at the present time arrive at safe and conservative approximations for thermal loading. Such limits or standards must be subject to revision as additional data are provided. However, at this stage it is important that resource standards be established since such action will clearly define the principle upon which future decisions can be expected.

The map of projected or proposed nuclear power plants generating on Lake Michigan shoreline is exceedingly impressive. The anticipated power needs for Michigan and adjacent states can only lead one to believe that many major installations will be constructed in the future. Thus it is essential to establish appropriate regulatory criteria at this time.

Frank F. Hooper, Professor of Fisheries and Zoology.

University of California, 1939. A.B.
University of Minnesota, 1948. Ph.D.
University of Chicago, 1942-43 (meteorology).
Oak Ridge Institute of Nuclear Studies, 1957.
Teaching Assistant Zoology, University of Minnesota, 1940-42, 1946-48.
Air Force Weather Officer, Alaska, 1942-46.
Instructor, University of Michigan, 1948-52.
Biologist, Institute for Fisheries Research, 1952-1962; 1964-65.
Aquatic Ecologist, Division of Biology & Medicine, U.S. Atomic Energy Commission, 1962-63, 1966.
Biologist in Charge, Institute for Fisheries Research, 1965-66.
Professor of Fisheries, School of Natural Resources and Professor of Zoology, College of Literature, Science and the Arts, 1966-Present.
Treasurer of American Microscopical Society, 1953-56.
Executive Committee, American Society of Limnology & Oceanography, 1957-1960.
President, American Society of Limnology and Oceanography, 1966.
Associate Editor of Journal of Wildlife Management, 1959-1961.
Associate Editor of Transactions of the American Fisheries Society, 1964-1968.
Associate Editor of Ecology, 1970-present.

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MRS. BOTTS: At this time, I would like to introduce Dr. John Bardach who, as I mentioned before, is a distinguished aquatic ecologist, who has consented to appear as a consultant to the public.

Dr. Bardach.

STATEMENT OF JOHN E. BARDACH, PROFESSOR OF NATURAL RESOURCES, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN

DR. BARDACH: Mr. Stein, conferees, ladies and gentlemen. I am John Bardach, and I am a professor of natural resources at a reasonably well known educational institution.

My credentials are attached to the statement which the conferees have in their hands. I would like to add that I came here paying for my part of the jet emissions that are added to the skies over Lake Michigan and that I am extremely concerned from a long-range point of view over what is happening. (See Pp. 1737i-1737o)

I would like to preface my remarks by saying that on my flight today I paid for insurance for a rather unlikely contingency, namely that my airplane would drop down. We are concerned here with what insurance we should

J. E. Bardach

pay for another contingency, a contingency that in my scientific opinion is far more likely to occur, namely the galloping eutrophication of Lake Michigan if heat is permitted to be discharged in an unabated fashion as is now planned over the next 20 or 30 years or so.

I think the key word here is "eutrophication," because from it follow all other consequences.

It has been though not completely but reasonably well established that during crucial periods of the year -- that is in the spring and in the fall -- the shore waters of Lake Michigan form a rather discrete entity. Now, why are those crucial periods?

The spring is a crucial period because in it unfold the succession of algal species. If the heat regime is altered upwards, we will have undesirable algae early and we will have different successions of algae, as has been demonstrated in some cases in smaller lakes and as is apparent now even in some shore regions of Lake Michigan. Let me add that it is not a question of heat being the main or the only culprit. We all know this. It is a complex situation in which effluents may hold the limiting factors for eutrophication, but in which heat unquestionably -- if these factors are present -- speeds the biological processes.

J. E. Bardach

The other crucial period is in the fall where there is an equally discrete segregation of water in the shore regions. In the fall, a rather unique set of fishes, the whitefishes, come to spawn, and they come to spawn in the shore areas. They spawn only if the water temperature goes down at a certain rate. We do not know what this rate is, but we do know that the water temperature has to become lowered at a certain rate and reach a certain lower temperature for these fishes to spawn at all.

Now, it is quite possible that regionally or for that matter locally these conditions will be so altered that the spawning of whitefishes will be inhibited. Recently we have introduced salmon into Lake Michigan. They are doing very well. It is possible regionally, again, locally that the temperature changes, if permitted to occur in an unabated fashion, will affect some of the biological characteristics of the salmon.

I will give you an example. The conversion efficiency, that is the efficiency with which the salmon converts food into its flesh, declines from 32 to 22 percent as the temperature goes up from 56 to 67 degrees Fahrenheit. There are many other such influences that are temperature-conditioned or temperature-influenced. I am not telling you anything new if I say that there are very many of them we do not know.

J. E. Bardach

I was in Switzerland this spring, where I grew up, and in the last 30 years a very beautiful lake, Lake Zurich, in which I used to swim as a boy, has undergone irreversible changes. It is now a rather nasty soup. When I talked to some of my friends in Switzerland they said, "What are you going to do with your Great Lakes? We understand that some changes have already occurred." -- And I think that the Stoermer-Yang diatom studies indicate this. -- "Are you going to stop what we didn't stop?"

I said, "I don't know. I hope we will."

Let me stress: The effects of eutrophication, including the partial effects of heat, are cumulative and not lineal. They start slowly, accelerate, and accelerate very fast once they have started to do so. In fact, a before-and-after study done at a plant site several years after the plant has started putting heat into the lake may tell you nothing or so little that you can't make any predictions from it. Natural variations may mask these effects, but it is not difficult to assess that the contribution to the heat load of the lake from a large number of plants in the southern end would have a cumulative effect that works in a synergistic fashion with the enrichment. There is nothing naturally good or bad about either a trout, a salmon or a whitefish as opposed to a perch, carp, sucker, or alewife lake.

These are sociocultural values but I think that we have stated them.

Lake Michigan is a unique environment. There isn't another one in the world. And we said that we would rather have a lake trout, whitefish, and salmon lake. If we do not want to wake up -- not "we," but perhaps your children and some of the young people in the audience -- if we do not want to wake up in the year 2020 reading in the newspaper that there was a severe carp die-off in the shore waters of southern Lake Michigan because of nocturnal oxygen depletion, if we are to keep a unique natural environment as little changed as possible, we must as a society, as one of the many things we do, take measures to hold to an absolute minimum the heat discharges to the shore waters of Lake Michigan. Whatever the technical means by which we do this, these are open to discussion, but there is no question about the fact that unabated discharge of heat into Lake Michigan will have the effects predicated on analogies by many biologists.

In fact, even if we do abate heat discharges, we may not have much of a chance. It may already be too late. Eutrophication is like a disease. It has an incubation period. It starts rather slowly and then it becomes galloping. But if we don't try now to do something about this one factor which we are here to consider and discuss, we do throw away much of our chance to keep Lake Michigan as it is now or perhaps even improved.

Thank you. (Applause)

MR. STEIN: Thank you, Dr. Bardach.

Are there any questions?

MR. CURRIE: Yes, Mr. Chairman.

MR. STEIN: Yes.

MR. CURRIE: Did I gather, Dr. Bardach, that one of the things you said was that whatever adverse effects heat discharges may have on the biology of Lake Michigan are likely not to be reversible? We had statements from several industry witnesses the other day that if there were changes in the biology of Lake Michigan due to heat discharges they were likely to be reversible. I take it you disagree.

DR. BARDACH: No, I didn't say any such thing. I did not say they were irreversible. They are, in fact, reversible or very likely to be so. But what is the time frame? We are now in 1970. By 2000, I understand, the heat load should be from various sources and not only the power companies, about 10 times what it is now. At the same time it seems doubtful to me that by then we will have cleaned up all our effluents.

The changes of eutrophication are reversible, but I think Lake Michigan is a case where these changes are likely to go slowly because of the sinking effects of the lake.

MR. CURRIE: And this is true of whatever part of eutrophication is caused by heat as well as whatever part of it is caused by too much nutrient, in your opinion?

MR. BARDACH: I would think so.

MR. STEIN: I think this is a very important point and I want to see if I understand it.

If I understand what you are saying, you are saying that perhaps the total effect of eutrophication can be reversible in a very long-range time frame. I think that is what we know generally about eutrophication. But I think what Mr. Currie was referring to is that, even in the short range, if we had heat in the lake and that proved to be harmful, this is just transitory. By removing that heat, the effect of that heat would be dissipated maybe in a season or two, and we wouldn't have to wait for this long-time recovery in order to reverse eutrophication. We know how long that is, having tried to reverse eutrophication in other bodies of water.

DR. BARDACH: Well, these are hypothetical situations, Mr. Stein. Let us assume that we go along as we are going now, and in 1985 we say, "Okay, enough. Tomorrow no more heat into Lake Michigan."

Are you asking me how fast the reversal of eutrophication would be?

MR. STEIN: What I am saying -- I am trying to split this into two questions. I believe I have read enough of the literature, been in enough conferences, participated in enough meetings and discussions to know how difficult it is to reverse eutrophication. I think that the point that Mr. Currie raised is a closer one here. That is, if we stop heat say by 1975 if there proves to be damage, by stopping that heat we will not have accelerated eutrophication on our hands because of that heat. We will not have to wait for that slow process of reversal if it ever is to come. But once we stop the heat, the effects of that heat or any damage it may have caused will immediately disappear. The heat wouldn't have caused any damage at all, except in the sense that it is going to have a transitory impact on the lake.

DR. BARDACH: Well, I am going to make a guess. That is all I can do. It would still take a number of years. I don't know how many. But if you could pinpoint the effects; if you could abstract the effects of heat and take the effects of heat singly, and nobody can do this now -- it would still take a number of years -- and I don't know how many -- before the aftermath of these effects or the conditions to which these effects have given rise would disappear.

MR. STEIN: Thank you.

Are there any other comments?

MR. FETTEROLF: Dr. Bardach, I think you are basing your premise on if a large segment of the shore waters of Lake Michigan were warm.

Now, if you had a plume from a single plant and for some 3 or 4 miles down shore from there you had increases in algal growth possibly due to added heat, and then you ceased that input of heat, would the reversal then take several years or a short time?

DR. BARDACH: It would take a shorter time; probably not several years. But -- well, let me say again: My concern is for the year 2000 and the year 2050.

MR. STEIN: Are there any other comments or questions?

MR. CURRIE: Yes, Mr. Chairman.

MR. STEIN: Yes, Mr. Currie.

MR. CURRIE: I think I might be helped a little along this road, Dr. Bardach, if you could give us a more precise indication of the way in which heat increases eutrophication. We have heard from several people on this subject, and I have been trying to get it straight and I am not sure I have it. I think we have been told so far that heat inputs will not increase the total mass of algae present at any given time in the lake. Would that square with your opinion?

DR. BARDACH: Well, again, you see, you are trying to divide something that is hard to divide. But let me say this: Assuming that you have all signs of algal growth early during the year because of changed heat characteristics of the inshore waters, you would have for that particular alga a longer time to multiply than you would otherwise have. So you would, at this point, increase the total amount of algae that are present as opposed to the amount of algae that would have been present had no heat been discharged.

MR. CURRIE: Yes, I think that is an important point, and that helps me a good deal.

Is that change one that would be irreversible? I would think that the next year, if the temperature of the lake were reduced, that then you would not duplicate that condition, is that right?

DR. BARDACH: Locally -- well, if you talk now about one plant and you stopped completely heat discharge from that plant, the next year you would, of course, not duplicate that condition, but that does not mean that in that particular year you would have no algae at all.

MR. CURRIE: Dr. Bardach, have you conducted studies on the effect of heat on eutrophication in Lake Michigan or in comparable waters?

DR. BARDACH: I have not conducted studies on heat effects on eutrophication in Lake Michigan, but I have done some studies on comparable waters. The unfortunate thing is that there are no comparable waters, and there are no even slightly comparable waters on which such studies have been conducted. All such studies have been conducted on smaller bodies of water.

The only analogy we have -- and there again they are unfortunately rather incomplete cause-and-effect -- for what they are worth -- data on Lake Erie and Lake Ontario. And Lake Erie and Lake Ontario have deteriorated.

In Lake Erie, the change in average lake temperatures since -- I think it was -- around the 1920's by only 2 degrees Fahrenheit is suspected -- you see, you are sort of extrapolating backwards -- is suspected to have caused the demise of the lake herring and related fishes which were living at that time at the extreme range of their temperature tolerance, and that this gradual warming has been tantamount to displacing Lake Erie 50 miles to the South.

Unfortunately the studies of heat effects on eutrophication and the studies specifically of heat on fishes and other aquatic organisms are relatively scarce. There are some -- for instance, I would like to know -- the statement has been made that young fishes of this peculiar and specific species complex that we have in Lake Michigan may be particularly vulnerable during the early part of their lives to heat loading.

Now, there are lots of things we don't know about them. For instance, we don't know whether all of them or only some of them have to come to the surface to gulp air to fill their swim lungs. If we knew this we might be able to make a somewhat better prediction, given hypothetical situations, of surface temperatures.

Let me add one other thing: I am not concerned about fish kills as such. Well, no, it would be wrong to say I am not concerned; of course, I am. But I am not as concerned about the 5,000 fishes that die because some powerplant shut off its effluents and the fishes were subjected to a cold shock, say, or the reverse. I am much more concerned about the very slow and gradual effects. I have done or my students and I have done some studies on the effects of raising the temperature in the fishes' environment close to its lethal temperature. We have looked at what does this do to the animal's behavior? We have studied the most heat-tolerant fishes -- fishes that one day may abound in Lake Michigan. And we have found that as you get past the comfort zone of these fishes, their behavior becomes quite different; they become very much more aggressive to one another; they cover much larger distances in search for food and comfort. They may, in fact, be very much disturbed in their reproductive behavior.

Now, that is something that will have effects that go over 4, 5, 6, 7 years or longer, and eventually their numbers in the lake or a body of water are reduced. None died, or nobody died earlier than they should have. But he or she was adversely influenced.

MR. STEIN: Are there any other questions from the panel or --

Mr. Petersen.

MR. PETERSEN: Thank you, Mr. Chairman.

Dr. Bardach, as I understand what you have said, you are concerned principally with the effects of heat over the long range.

Dr. Bardach, would that be properly interpreted to mean that it would not appear that the effects of any one plant would be noticed in Lake Michigan?

DR. BARDACH: In answering this, let me say that I have great sympathy with the power industry in one respect: They have been subjected to a lack of guidelines from public quarters, quite understandably so.

Now, one plant may or may not have a local effect. That is all I can say.

MR. PETERSEN: You wouldn't expect one plant to have by itself an effect on all of Lake Michigan in the manner in which you have described, in what you have had to say today?

DR. BARDACH: I think it only fair to say no.

MR. PETERSEN: Do you theorize that the presently existing plants are having that effect?

DR. BARDACH: They unquestionably contribute to eutrophication; to what degree, I am not prepared to say. Let me be quite frank with you. It may be that this effect is so small that it is very hard, if not impossible, to detect.

MR. PETERSEN: In this regard, you are relying, as I understand, on the idea of a separate and unmixing body of -- what was it? -- shore waters?

DR. BARDACH: Yes.

MR. PETERSEN: What do you mean by shore water?

DR. BARDACH: I mean water to a depth of about 10 meters, which during certain parts of the year, as set forth in several publications -- one of them "The Lake Currents in the Lake Michigan Basin," by the Federal Water Pollution Control Administration Great Lakes Region, November 1967, and again in this publication, "Physical and Ecological Effects of Waste Heat," as pointed out there, because of specific thermal effects on the water, there is a thermal barrier that prevents the mixing during certain parts of the year. I am not sure to what extent the duration of these separations has really been determined accurately. But let it suffice to say that they are part of the year, and I think they are not part of the year, the spring and the fall, where these thermal barriers exist, that would separate out about 10 percent of the lake water from the rest of the lake.

MR. PETERSEN: Does this thermal barrier keep the mixing of the lake totally or is it merely a partial bar to mixing?

DR. BARDACH: During the time it exists?

MR. PETERSEN: I presume -- you said it is not a continuous phenomenon.

DR. BARDACH: No, when the bar is removed, there is mixing with -- well, in the summer, there is mixing with the epilimnion, and if the bar does not exist, during turnover times, then there is mixing in the entire lake.

MR. PETERSEN: My question was: Does the bar prevent mixing between the inshore and the offshore part of the lake totally or is it only a partial bar to mixing during the time that it exists?

DR. BARDACH: From what I know about the matter, it does prevent effective mixing.

MR. PETERSEN: Now, doctor, have you performed any studies in relation to the thermal bar in Lake Michigan?

DR. BARDACH: I said from what I know.

MR. PETERSEN: Are you familiar with the study which Dr. Pritchard described when he was here, wherein he noted not less mixing but greater mixing over the thermal bar were difficult studies?

DR. BARDACH: I wasn't here when Dr. Pritchard presented his testimony.

MR. PETERSEN: You were not aware of that?

DR. BARDACH: I was not aware of that.

MR. PETERSEN: Could that in any way have any change?

DR. BARDACH: Yes, certainly. If this were found, if this were ascertained, certainly.

MR. PETERSEN: As I understand it, you have done no studies within any existing thermal plumes.

DR. BARDACH: I have done tank studies with thermal plumes, again on the behavior of fishes.

MR. PETERSEN: What kind of studies?

DR. BARDACH: Tank.

MR. PETERSEN: Ah! But not within --

DR. BARDACH: No, I have not studied thermal plumes within Lake Michigan.

MR. PETERSEN: All right. You have no reason to believe that fish will swim into the thermal plumes and remain there to the point that they are killed or hurt?

DR. BARDACH: Sometimes yes; sometimes no.

MR. PETERSEN: Sometimes you believe they will swim in and be killed?

DR. BARDACH: Sometimes I believe they may well be, if not killed, so affected that they do not recover or are susceptible to other either disease or environmental factors that may befall them after they have had either a heat or cold shock.

MR. PETERSEN: Ah! From shock, you are speaking?

DR. BARDACH: Yes. Well, I think you have to separate. There are unquestionably instances where it may happen that the fish are actually killed, not immediately but within -- you see, a fish doesn't die like this --

(Dr. Bardach snapped his fingers) -- it is affected and it may be a few hours later that it gives up the ghost.

But in other cases it may get a heat or a cold shock and may die even 2 or 3 weeks later, and it is very difficult to say that this was it. Certainly in the lake I can only make this study under highly controlled conditions.

MR. PETERSEN: It is my understanding that you reached this present theory at least 2 months ago.

DR. BARDACH: Which present theory?

MR. PETERSEN: The present theory which you have.

DR. BARDACH: I have many theories.

MR. PETERSEN: The theory of damage to Lake Michigan from thermal effects that you have enumerated to this audience today.

DR. BARDACH: No, I wouldn't say this, Mr. Petersen. I wouldn't say this. I have been concerned about the effects of eutrophication on Lake Michigan for quite awhile. When I helped Consumers Power Company to design the before-and-after study for their Palisades plant, I stated in the document that I presented to Consumers Power Company that I am very concerned with possible eutrophication effects -- synergistic eutrophication effects of effluents and heat.

MR. PETERSEN: In this regard, doctor, has Consumers Power Company asked you for the scientific basis of your conclusions?

DR. BARDACH: Consumers Power Company has, at this time, accepted my suggestions to conduct a study. Consumers Power is to be congratulated for having initiated and being in the process of conducting this study. Later -- that was several years ago -- as I have continued this, I have become more concerned, and my concern has reached somewhat greater proportions than it had when I designed or helped to design this study for Consumers Power Company.

Consumers Power has asked me, at this point, to be good enough and tell them what kind of study they should conduct -- well, how can I put it? -- to foretell with as much confidence as possible the effects of the Palisades plant. I am in the process of thinking about how this might be done.

MR. PETERSEN: And has the fact that you have performed work for Consumers Power Company prevented you from speaking your mind today or any other day in Indiana or elsewhere?

DR. BARDACH: It has not.

MR. PETERSEN: Thank you, Dr. Bardach.

MR. STEIN: Any other comments or questions?

Dr. Bardach, will you wait?

MR. HIPKE: My name is Jack Hipke, Wisconsin Power and Light Company.

First question: You say that eutrophication is discrete in the spring and fall in small lakes. Where does this heat come from?

DR. BARDACH: Eutrophication can occur without additional heat sources, and does occur without additional heat sources, and I have never said that the heat that will be put into Lake Michigan causes eutrophication.

MR. HIPKE: Okay. Question number two: Are the fish that you have mentioned in your study in the conversion of food able to make a choice in temperature?

DR. BARDACH: Are they able to make a choice in temperature in the experimental situation?

MR. HIPKE: Correct.

DR. BARDACH: No, they are not, because such a study would be impossible to perform.

MR. HIPKE: Isn't it possible, then, that fish in actual surroundings could make a temperature choice and therefore there won't be a depletion in the weight of the fish due to the conversion of food?

DR. BARDACH: It is certainly possible. But let us assume that the salmon has no particular desire to go to some particular place. If he does so, and if, in fact, it could consciously ascertain that his conversion is adversely affected, it is likely that he would choose, but the fish doesn't know whether he is in -- what his conversion efficiency is.

MR. HIPKE: Question number three: You mentioned oxygen depletion in the year 2020, I believe.

DR. BARDACH: Yes.

MR. HIPKE: Was this in reference to the area of the plume?

DR. BARDACH: No, it had no particular reference. This was a very hypothetical situation, in reference to almost anyplace in southern Lake Michigan. And let me add: It may well be that you have this contingency even if you have no waste heat.

MR. HIPKE: Okay. Thank you, doctor.

MR. STEIN: Are there any other comments or questions?

MR. COMEY: I am David D. Comey, representing Campaign Against Environmental Violence.

Dr. Bardach, you mentioned that certain fish have to go up to the surface in order to fill their air bladders very early in their life. Could you describe a little bit more what that mechanism is and what it would mean if on further knowledge it turns out that many species have to accomplish this function?

DR. BARDACH: Yes. Fish use their air bladders or gas bladders to assume weight or density equal to that of the water. That makes it easier for them to remain at a particular depth level. They have to expend less muscular energy to do so.

There are essentially two kinds of fishes: Fishes that have a duct to the esophagus from their gas bladders, and those fishes that have not.

In either case, much of the exchange of gas in the swim bladder -- that takes place through special tissues that secrete gases from the blood.

But to begin with, when the fish first hatches, very many species, in order to stimulate that tissue to perform, have to take one small gulp of air, and that small gulp of air, of course, has to be taken at the surface. Now, there are, again, hypothetical situations. Let us assume that a small hatch of these fishes came to the surface. They are small fishes, not very well able to move and swim along, and they are carried by surface currents into an area of very much higher temperature -- say 5 or 6 degrees higher than the one in which they were immediately before. As they cannot navigate very well at that stage, they might be trapped there, and thus either die or be so affected that they don't survive the next few weeks. It is indeed likely that those places are rather small, if they exist at all. But if I look at the perimeter of southern Lake Michigan and the powerplants that are planned there or may undergo modification to make them somewhat larger, I think that these areas may become somewhat more extensive and may depress the survival success of these species. We do not know to what extent, but the possibility certainly exists.

MR. COMEY: Mr. Petersen, counsel for Consumers Power Company, asked you a question about a study concerning some dye-testing currents. Are you familiar with another study done by Gabriel Csanady at the University of Waterloo several years ago indicating that dyes run through the condenser of a nuclear powerplant on Lake Huron tended to hug the shore for many miles and not disperse? Are you familiar with that study?

DR. BARDACH: No, I am not.

MR. COMEY: Well, let me go to another question then. You are familiar with the food chains of salmonids in Lake Michigan and other cold water lakes?

DR. BARDACH: Yes.

MR. COMEY: Would you say that benthic organisms that would be entrained at a condenser intake located approximately 3,000 to 4,000 feet from shore would survive a 100 percent Delta T in the condenser of 25 to 28 to 30 degrees Fahrenheit?

DR. BARDACH: I doubt it.

MR. COMEY: Do you think Mysis Relicta, for example, would survive such a thermal shock?

DR. BARDACH: Mysis Relicta happens to be a very cold-loving crustaceon, and I am not aware of any temperature tolerance or thermal shock studies that have been done on Mysis Relicta. It would be my guess that they would be very seriously affected.

MR. COMEY: Is the zone in which most of these intake pipes are located which are out there in order to get at least 25 feet or 35 feet of depth for the Corps of Engineering navigational purposes -- are they located in a zone of high biological production from benthic organisms and other elements in the fish food chain? Is that a zone of greater productivity than the immediate inshore zone?

DR. BARDACH: By and large, yes. But I think you would have to really look at each particular plant intake before you could make any general pronouncements.

MR. COMEY: One last question and that is: Are fish attracted to a warm-water discharge?

DR. BARDACH: Oh, yes.

MR. COMEY: Do they have a tendency to prefer water that is, say, just a few degrees below the level at which they tend to exhibit the characteristics that you have earlier described? In other words, are they like butterflies in the sense that they go towards light when perhaps if they knew better they shouldn't?

DR. BARDACH: Well, some fishes do. I would suspect that some of the fishes we are most concerned with might not. Some studies have been done at Lake Mendota where there is a very, very strong discharge of heated water, and bluegills, carp, yellow bass, apparently were attracted to the outflow, and they were attracted to the outflow in part because in the outflow zone there happened to be more food at certain times of the year.

Let me say here that I am convinced -- and I said so in a number of statements that I have made -- that there are beneficial effects on fishes. You have got to make your choice. What is it you want to fish for?

Let me please add one more thing. There is a possibility in heat abatement to turn heat into a rather beneficial contingency. It would be possible, ladies and gentlemen, with 100 cubic feet per second of equithermal waters -- that is water that has the year-round a temperature about 17 to 18 degrees centigrade -- to raise in an intensive fashion a million pound of trout. So there are possibilities here.

MR. COMEY: Do you know of any present powerplant that plans to use that --

DR. BARDACH: I do know of several powerplants that use heat, One is the Long Island Heat and Power, which uses it for oyster-growing. And there are several powerplants -- many in Russia -- that do this. Experiments have been conducted with growing fish in heated effluents in Hindustan, in Scotland, where it was possible to speed the rate of growth of perch and sole to maturation and legal size to 1 year as opposed to 3 years in the Irish Sea.

MR. COMEY: Yes, I believe the New York Department of Conservation plans such a fish hatchery at the Bell Station on Lake Cayuga, but the Bell Station did not materialize.

DR. BARDACH: Well, there is a problem here, Mr. Comey, and that is that the amounts of heated water are so great that only a part of it could adequately be accommodated in an economically sound enterprise.

MR. COMEY: Thank you very much.

MR. THOKE: My name is H. Thoke. I am a representative of the State of Wisconsin Southeast Chapter of Trout Unlimited.

This question is related to a question from the representative from Wisconsin Electric Power Company regarding choice of the fish going to a warmer or a colder area of a plume. What effect would a heated plume have on the migrating instinct of the trout and salmon that are presently in the lake? Would it deter them for accomplishing the migrating instinct to go up the stream to spawn?

DR. BARDACH: You are asking me a very difficult question. Under certain conditions, it is possible that it might. It depends at what stage of their migration they encounter this heated water.

MR. THOKE: Obviously the thing I am trying to point out here is that there is another approach to, I think, the direction the question was directed, and I will just leave it there.

DR. BARDACH: Yes. Well, I think that one thing, gentlemen, if you may permit me to say so -- one thing that these questions brought out is that there is a heck of a lot we don't know.

MR. STEIN: Go ahead.

MR. PETERSEN: O. K. Petersen again.

You were asked a question about benthic organisms entrained in water coming through a plant. Do you envision many benthic organisms being entrained in water moving at one-half of a foot per second?

DR. BARDACH: I couldn't answer that question, Mr. Petersen.

MR. PETERSEN: Would you expect benthic organisms so entrained and if hurt, damaged, or killed, to significantly affect the benthic population in the area of a steam electric generating plant?

DR. BARDACH: It would depend -- well, probably it would not have, but let me add one other thing. It may be that if there is a benthic organism so entrained, and if it is spewed out again and it is half dead, it may still be eaten by a fish. But I don't think that these are really -- well, these are questions directed at me as a physiologist and I can only hedge because, as you notice, we just haven't got the data, and I can give you best guesses.

But let me repeat: The concern is one about synergistic overall long-range effects.

MR. PETERSEN: And, doctor, you haven't yet replied to Consumer Power Company's request for the background on your theories, have you?

DR. BARDACH: Would you like me to tell you here what I wrote to Mr. Brandt?

MR. PETERSEN: I have seen the letter which you wrote to Mr. Brandt.

DR. BARDACH: Well, I am trying to do so as fast as I possibly can . Mr. Petersen, it may well be -- it may well be that I have to throw up my hands, not that I cannot help you, but that I cannot help you to satisfy you. It may well be -- (Applause) -- it may well be that we have to mount these studies in a somewhat different way.

MR. STEIN: Thank you.

Are there any other comments or questions?

Well, thank you very much, Dr. Bardach.

Mrs. Botts, are you ready to conclude?

MRS. BOTTS: Very sorry our presentation has taken so long, and I am aware that there are people waiting. My conclusion will be quite brief.

It should be obvious that the expert witnesses you have just heard have not appeared here in support of a particular point of view. I myself believe that is why their participation in this procedure is all the more important,and I wish to express the gratitude of the Lake Michigan Federation and the Open Lands Project to them.

Earlier I stated that I would conclude by making a proposal for an alternative of protecting the lake to adoption of the Department of Interior proposal to prohibit discharge of heat into Lake Michigan. Before discussing it, I would like to make clear that in the absence of any other alternative, the Open Lands Project will continue to support the Department of Interior recommendation.

My proposal is to establish a new means of siting powerplants, based on public participation through review by hearings in the early stages of the process, and with enforcement powers lodged with an interstate agency established for the purpose. Policy for the agency would be determined by an advisory commission representing various sectors of the public, the power industry, and State and local governments.

The first step toward establishment of this new system would be development of criteria to serve as guidelines for the following processes:

1. The location of powerplants.
2. The operation of powerplants.
3. Means of evaluating environmental effects of operation of powerplants.
4. Definition of conditions under which powerplant operations would be suspended temporarily and/or permanently.

A good start toward development of criteria may have been made in this enforcement conference, where thanks to the brashness of the Fish and Wildlife Service, the issues are at last out on the table. Perhaps the process could be carried further by a roundtable conference in which the scientists would be free to challenge each other and members of the public free to challenge them.

I am certain the Lake Michigan Federation advisory council would welcome an opportunity to join with Commonwealth Edison, other power companies, and the staffs of the various Interior agencies in planning and carrying out such a conference.

When it met, I do not think there would be any disagreement that the first task would be to define the research needed and to set a timetable for its accomplishment.

Parallel with establishment of criteria, the States around the lake would have to enact their own legislation in support of the interstate siting commission, and approval of Congress would have to be obtained.

Obviously, this is a very cursory discussion of a complex process, but it is offered here to demonstrate that conservationists object to the way powerplants have been sited in the past, not to their being sited at all. I believe this conference has demonstrated the urgency of arriving at a decision on the question of whether the existing nuclear plants should be permitted to operate as constructed.

Because of the time that would be required to carry out my proposal, even if adopted, I see no alternative except interim acceptance of a prohibition against discharge of heat into the lake, and soon, in the interests of power as well as the lake.

If at this point the power industry continues to refuse to accept the public desire for prevention of thermal pollution, then it should be recognized that responsibility for any future of failure of power supplies rests with the industry that refuses to fulfill its function rather than to change the way it carries that function out.

Thank you.

MR. STEIN: Thank you, Mrs. Botts. (Applause)

Mrs. Botts, you suggest a procedure where we have a forum for scientists to confront each other, and to be questioned by the public. I have been here for a week and I think that is what has been happening. This is a rhetorical question you don't have to answer. Also I wonder, Mrs. Botts, if you have ever checked -- because this is one of my fields of specialty -- on how long it has taken us in the past from the idea of a reception to get an interstate agency established in any field in water.

MRS. BOTTS: I am aware of that.

EXISTING AND PROPOSED NUCLEAR POWER PLANTS ON LAKE MICHIGAN
FACT SHEET

September, 1970

Plant Name,	Zion 2 units	Donald Cook 2 units	Point Beach 2 units	Palisades 1 unit	Kewaunee 1 unit	Bailly 1 unit	Big Rock 1 unit
Location	Zion, Ill.	Bridgman, Michigan	Two Creeks Wisconsin	South Haven Michigan	Kewaunee Wisconsin	Burns Harbor, Ind.	Charlevoix, Michigan
Company	Commonwealth Edison	Indiana & Michigan Power Co.	Wisconsin Electric & Wis-Mich	Consumers Power Co.	Wisconsin Public Service Co.	Indiana Public Service Co.	Consumers Power Co.
Capacity, Megawatts	1085 each unit	1054 1060	497 each unit	700	527	657	75
Cooling Water,* Gallons/Day	1 billion each unit	1 billion each unit	500 million each unit	700 million	520 million	660 million	70 million
Intake	2600 ft. offshore	2200 ft. offshore	1750 ft. offshore	3500 ft. offshore	1600 ft. offshore	No permit application	1600 ft. offshore
Discharge	760 ft. offshore	1200 ft. offshore	150 ft. offshore	Canal to Lake	220 ft. offshore	No permit application	Canal to lake
Maximum Temperature Elevation	19.6 degrees	21 degrees	19.3 degrees	28 degrees	19.2 degrees	About 20 degrees	20 degrees
Construction Permit Date	December 1968	March 1969	July 1967	March 1967	August 1968	Announced Feb. 1970	1960
Scheduled Operation	1972 1973	1972 1973	1970 1971	Spring, 1970	1972	1976	1962
Engineer-Architect	Sargent-Lundy	American Electric Service Corp.	Bechtel Corp.	Bechtel Corp.	Pioneer Service & Engineering	Sargent-Lundy	Bechtel Corp.
Reactor Contractor	Westinghouse	Westinghouse	Westinghouse	Combustion Engineering	Westinghouse	General Electric	General Electric
Unique Environmental Factors	Multiport diffuser discharge, small site	Shore erosion problem, Harbor permit sought	Five miles from Kewaunee	Highest discharge temperature on lake	Five miles from Two Creeks	Inside Nat'l Park, warmest intake water	Smallest nuclear plant on lake, coldest water
Current Status	Much public opposition, 2 lawsuits pending	Discharge distance increased, 1 lawsuit pending on erosion damage	Intervention filed to oppose operating license	Intervention hearing underway since June	On schedule	Capacity increased, public opposition before construction	Experimental and only operating reactor on lake

* All the nuclear plants now being planned for Lake Michigan are of the pressurized water reactor type and are designed to use once-through cooling techniques, except the Big Rock and Bailly boiling water plants.

This fact sheet has been prepared by the Open Lands Project, 53 W. Jackson, Chicago, Illinois 60604.

MR. STEIN: Thank you.

May we hear now from State Representative Robert E. Mann?

STATEMENT OF STATE REPRESENTATIVE ROBERT E. MANN, CHAIRMAN, LAKE MICHIGAN AND ADJOINING LAND STUDY COMMISSION, CHICAGO, ILLINOIS

MR. MANN: Chairman Stein and other conferees. I am appearing before you today as chairman of the Lake Michigan and Adjoining Land Study Commission of the State of Illinois to urge that you adopt the 1-degree Fahrenheit thermal standard recently recommended by the U. S. Department of the Interior and that you do everything within your power to see that your respective State water pollution control agencies or State legislatures make this standard enforceable under your State law. The opportunity to adopt a thermal standard which will protect Lake Michigan is a rare if not unique opportunity for this conference. Hopefully no serious irreversible damage has yet occurred in Lake Michigan because of past and present discharges of heat. Action now can protect the lake from the very real prospect of future damage.

Hon. R. E. Mann

All too often in the past the attitude of the people who had the power to preserve the lake has been either to wait until damage has occurred before acting or to take action without knowing it would solve expected problems.

To date, two Federal-State conferences have been convened to deal with pollution of Lake Michigan. There should never have been any need to call these conferences. If action had been taken in time, the pollution of the lake would never have occurred. Let me be more specific.

The first conference which dealt with Lake Michigan was convened in March of 1965. This conference which centered on the Calumet area took two basic steps to abate the pollution which was reported in a United States Public Health Service document published a year earlier. First, it adopted water quality criteria for the lake and surrounding waterways; second, it adopted requirements for improvements in the waste treatment methods of municipalities and industries, setting deadlines for completion of these improvements.

On first glance this sounds fine. But the standards specified only how bad we would let lake water become, not how much polluters would be allowed to dump into the lake. And the schedules for waste treatment improvement have often been laxly enforced.

Hon. R. E. Mann

As could have been expected, in August 1969, a preliminary report of a technical committee which had been appointed to "assess ... the results obtained by conference actions and determine whether further action by the conference would be required by the conferees to achieve satisfactory water quality in the conference area, ..." concluded that in general, water quality in the conference area was still unsatisfactory based on sampling data taken between August 1966 and March 1969.

The point is that long ago we knew our lake was deteriorating yet the Federal-State enforcement conferences took a circuitous route to meet the problem, without significantly bettering the situation. These conferences didn't go to the heart of the problem. They didn't regulate how much junk could go into the lake by adopting effluent standards. As a result of not adopting such standards we are at this late date, according to State of Indiana authorities, subjecting our lake to the following punishment in that State alone:

513,865 pounds of suspended solids per day

115,316 pounds of oil per day

12,828 pounds of cyanide per month.

Let me cite another example of the laxity which I think has pervaded these conferences in the past. In

April 1964 a report of the United States Public Health Service suggested that although algal growths in the Calumet area were not as dense as in other areas of the lake, this may have been due to the presence of toxic substances which inhibited algal growth despite the high nutrient content of the water in the south end of Lake Michigan. At the first session of the Two-State Conference in 1965, Mr. Hyman Gerstein of the Chicago Water Department stated that one of the most alarming features of the pollution picture was the indication of accelerated Lake Michigan eutrophication. He reported that nutrient levels had increased and that algal growths of nuisance proportions had occurred. Yet the conference made no reference in its recommendations to nutrient problems. In fact, by only requiring secondary treatment for municipal sewage, the conference virtually assured that phosphorus, which is perhaps the key nutrient to be controlled in preventing eutrophication, would continue to enter the lake in significant amounts. Only in 1968, when the Four-State Conference was convened did eutrophication receive significant consideration. And that action may have been not only too late but too little. Mr. Jacob Dumelle, formerly with the Federal Water Quality Administration and now a member of the Illinois Pollution Control Board, has recently stated that original estimates of Lake Michigan phosphorus input may have been too low. This raises the question of whether the 80 percent removal standard adopted by this conference is sufficient to retard eutrophication of our lake.

I realize I have strayed from the precise topic of your deliberations today. I felt it was necessary, however, to graphically demonstrate that you as conferees have some amends to make to the citizens of the States you represent. I can suggest no better way than by taking strong action to retard, if not eliminate, the heat loading that is currently plaguing and planned for our lake.

The Lake Michigan and Adjoining Land Study Commission has formally recommended the adoption of the proposed 1-degree Fahrenheit standard. This was done after a serious review of the available literature which left no doubt in our minds that deleterious effects were quite likely to result from gross thermal inputs into Lake Michigan, that the technology to avoid this danger was available and that no better method existed to spur development of alternative and nonpolluting sources of power. I am submitting for your consideration a copy of the brief we prepared to support these conclusions.

I must add one caution. The 1-degree Fahrenheit standard will be meaningless if powerplants are allowed to be constructed in such a way that tremendous amounts of heat will continue to pour into the lake through dilution by merely increasing the amount of cooling water used in the plant. I trust that such a safeguard will be made part of your recommendation.

I want to pause just a moment to say something about the Zion plant. When the Illinois Pollution -- when the permit was granted to the Zion plant, it was granted for the purpose of construction only; no commitment was made to Commonwealth Edison that they could operate. Now, when Commonwealth Edison, through its paid mercenary experts, testifies and implies that only one plant will do no damage to Lake Michigan, it is ignoring the realities of Illinois politics.

I have been in the Illinois General Assembly for 8 years. I know from bitter experience how effective and pervasive the special interests of this State are. If you permit Zion to operate without fully putting the burden of showing that no damage, no degradation to the lake will take place, then you will not be able to stop a ring of powerplants around this lake.

I hope I don't sound dogmatic on it; I hope I sound bitter, because it is from experience of 8 years on the Illinois General Assembly, and I am saying this pointedly to my constituents.

Chairman Currie, I know, has already demonstrated, I think, great expertise in his new role, but I want to share that one piece of experience that I have had as a member of the Illinois General Assembly.

I think Commonwealth Edison, I think this conference, I think State Representative Bob Mann, I think everybody else concerned with the lake owes accountability to the people of this State.

That lake is held in trust for the people of the State of Illinois, and I would hope that one of the resolutions which would come out of this conference is that Commonwealth Edison ought to be put on notice that the fact that they have invested millions of dollars into that plant has nothing to do with the welfare of the State of Illinois or with that lake. If they have made a mistake, that is their problem; that is not our problem. (Applause)

In closing, let me state a principle that I think should be the guidepost in your deliberations. Our natural resources are a public trust precariously held in your hands in this instance. As our trustee, you must demand that those who propose to tamper with the lake prove beyond any reasonable doubt that no deleterious consequences will result from their actions. After the delays of the past, nothing less than this is acceptable.

And I would add just one thing, Chairman Stein. I have not meant to go into the gunnysack with regard to past actions. These are over and past. But I think that all of us can learn from the bitter experience from the past and realize that the time is reached where we must now have no -- no further degradation of our land. Thank you very much. (Applause)

MR. STEIN: Thank you. Are there any comments or questions?

Mr. Mann, I would like to ask you one question, if you would wait --

MR. MANN: Yes, sir.

MR. STEIN: -- just for a second.

MR. MANN: Yes, sir.

MR. STEIN: I would like to get your views on that since you have had experience with this. As I understand it -- and I have heard this sometimes before in other areas of the country -- that you indicate that when these plants were built, and particularly the Zion plant, the construction -- the plant was built and now you are faced with operation. Is that correct?

MR. MANN: Yes, sir.

MR. STEIN: In light of that, what do you think of the proposal that we heard from the power industries that we permit them to discharge heated water into the lake and after a couple of years if you find it is doing damage to take corrective action?

MR. MANN: I don't like it because I don't believe it.

MR. STEIN: Are there any other comments or questions? If not, thank you very much, Mr. Mann.

MR. MANN: Thank you, sir.

MR. STEIN: Several of the people have submitted statements for the record, and without objection, I would like to put them in as if read: Charles D. Sigwart, Student Council on Pollution and Environment; Robert A. Butler, President of Rosemary Beech Association; and Dr. C. H. Mortimer, Director, Center for Great Lakes Studies.

We try to accommodate everyone, but I think we have come to the point where our reporter just has to have a break, and we are going to have a five-minute recess.

(Short recess.)

(The statements above referred to follow in their entirety.)

Statement on Thermal Pollution   Oct. 2,1970

Charles D. Sigwart   B.S. engineering, M I T 1967
currently a PhD candidate Northwestern University, Dept.
of Biological Sciences

representing: Student Council on Pollution and Environment (SCOPE), an advisory committee to the Dept. of the Interior; and Northwestern Students for a Better Environment (NSBE).

The current growth rate in energy production and in energy use per capita will probably continue. Inevitably a large part of the energy is transferred to the environment as waste heat. In view of this trend we must seriously consider the precedents we are setting. We must not view only the effects of single sources of thermal effluents today but must consider the total effects as the thermal load on our lake doubles redoubles with coming decades. Current practice favors applying the thermal load to nearshore waters which are the biologically most productive areas of our lake. If we continue the effect on Lake Michigan will be substantial. At a minimum, even small changes in temperature can cause large shifts in the relative numbers of various species of fish. It is not pertinent to argue relative merits of particular species, but it takes only small changes to disrupt the reproductive cycle of some species or to eliminate their food supply(1)(2). Another serious problem is that the nutrient levels in nearshore waters are approaching the levels found in Lake Erie and increases in temperature will tend to encourage excessive algal growth(3). These nearshore waters do not freely exchange with the rest of the lake due to the longshore currents and the periodic development of the thermal bar(4).

In view of the complexity of the problems we cannot hope for a simple standard which will protect the lake into the forseeable future. Therefore we reccomend that:

A. In granting permits to discharge thermal effluents it should be incumbant upon the applicant to show adequate reason to believe that his discharge will not cause ecological damage.

B. and that Thermal discharges should not be allowed in nearshore waters,including plumes swept there by currents, which exceed one degree Fahrenheit.

C. Larger temperature differences from ambient might be tolerated provided (A.) is satisfied and it is shown that heated water does not reach nearshore waters.

The need to protect the most biologically active waters is pointed up by the various reccomendations of the National Technical Advisory Committee on Water Quality Criteria in 1968 of a 3°F. standard for lakes and a 1.5°F. standard for estuaries in summer(5), particularly where spawning areas are involved.

These reccomendations are made with due consideration that there are technically feasible alternatives to reduce the thermal load on Lake Michigan which are economically feasible(6).

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(1) Mackenthun, *The Practice of Water Pollution Biology*, FWPCA, 1969,p.19ff

(2) *Physical & Ecological Effects of Waste Heat on Lake Michigan*, Bur. Commercial Fisheries, Great Lakes Fishery Lab, Sept. 1970, p.7-18

(3) ibid. p.78

(4) ibid. p.21-22

(5) National Technical Advisory Committee, *Water Quality Criteria*, 1968 FWPCA   P.33,P.42,p.70

(6) *Feasibility of Alternative Means of Cooling for Thermal Power Plants Near Lake Michigan*, FWQA August, 1970

Presented Oct 2 1970 to the Federal-State Enforcement Conference on Pollution of Lake Michigan and its Tributaries

Mr. Chairman: (To be entered as the record

My name is Robert Butler and as President of the Rosemary Beach Association I am representing that group at this conference. The Rosemary Beach Association is comprised of 33 families who live immediately north of the Donald C. Cook Nuclear Plant in Bridgman, Michigan. We are very much disturbed by the gigantic enterprise that is being developed next door. And in particular, we fear the consequences of thermal pollution since, according to present plans, millions of gallons of heated water will be discharged daily approximately 1100 feet from the shoreline. Prevailing winds in the summer will bring this plume of hot water directly to our beach. A prolific growth of undesirable forms of algae would render our recreational facilities completely unsuitable. Moreover, should the duration of ice formation in winter be shortened, our beach would be subjected to devasting erosion from the winter storms. On more general and important terms, we are gravely apprehensive about the future of the lake as a viable natural resource to be enjoyed and admired.

What will happen if the power companies are permitted to discharge hot water into the lake and our fears become a reality? A representative from the Michigan Water Resources Commission had a suggestion. At a public hearing before the Army Corps of Engineers in Bridgman, Michigan last year he exclaimed: "If you have a case, take it to court." But it would be absurd to believe that our group with its most modest financial resources could counter successfully a giant such as the American Electric Power Company. Because of the complexity of the problem, legal action on our

Butler - Page 2

part would be enormously expensive. We simply could not afford such an undertaking. Furthermore, we were distressed to hear this advice from an official of a state agency formed ostensibly to protect the public interests. This is why we feel the desperate need for a governmental board comprised of dispassionate experts in ecology; a board empowered to act decisively to protect our natural resources. To permit the power companies to increase the rate of eutrophication of Lake Michigan for purely economic reasons would constitute a stark betrayal of public trust.

Respectfully submitted,

Robert Butler

Robert Butler, President
Rosemary Beach Association
Stevensville, Michigan

Lake Michigan Beach Zone Waters: Variations in Temperature Arising from Natural Causes

by

C. H. Mortimer, Director
Center for Great Lakes Studies
University of Wisconsin-Milwaukee

September 1970

A Contribution to discussion of the Report by the U. S. Department of the Interior, Fish & Wildlife Service (September 1970), "Physical and Ecological Effects of Waste Heat on Lake Michigan", presented at the Third Session of the Federal-State Enforcement Conference on Pollution of Lake Michigan, 28-29 September 1970, Chicago, Illinois.

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*by

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Center for Great Lakes Studies
University of Wisconsin – Milwaukee
Milwaukee, Wisconsin 53201

Introduction

Seventeen years ago, on my first visit to this country, I began looking for clues to Lake Michigan water movements in the temperature records of municipal water intakes. Because of the large volume flow, the temperature of the raw water taken into the plant is virtually the same as that at the intake point, typically some 50 ft below the lake surface and some 5000 ft offshore, i.e., just outside the "beach water zone" defined in the above Report. I was astonished at the large and often rapid temperature fluctuations at the intakes in summer, apparently related to motion of the thermocline. I also discovered that, when the thermocline remained for several days near intake depth, wave-like fluctuations were seen (example in Fig. 1). These led to a study of internal waves, which continues today.

If the intake temperatures are plotted on a less open time scale than in Fig. 1, and stations on opposite sides of the lake are compared (Fig. 2), large, irregular fluctuations are apparent, and these are often out of phase across the lake. This behaviour indicates motion of the whole basin, involving an upwelling on one shore (producing low intake temperatures) and a "downwelling" on the other shore (producing high intake temperatures).

One of the principal questions before this Conference concerns "thermal stresses" which may arise in inshore waters of Lake Michigan from the expanding requirements of the power industry and other municipal and industrial users. The purpose of the present note, therefore, is to describe the natural background against which the anticipated "stress" must be examined; and a memorandum was prepared for the Conference before the recent receipt of the above Report. As that Report gives background information on the annual thermal regime of Lake Michigan, that portion I have therefore omitted. But I find that, presumably because of space restrictions, the Report does not treat the natural variability of temperature in more than a paragraph (p. 11) and in a greatly smoothed annual diagram (Fig. 6, "beach zone water temperatures"). The present shortened note may, therefore, serve a useful purpose in drawing attention to the conspicuous variability during summer and also by making the point that the Chicago water intake (used in the preparation of Rept. Fig. 6) shows much less summer variability than do intakes situated along the middle reaches of the basin.

Coastal Upwelling

The cause of the major fluctuations in intake temperature--upwelling induced by wind stress combined with the influence of the earth's rotation--is well illustrated by comparison of Figs. 2 and 3. By a fortunate coincidence, the Fig. 3 multi-ship survey was carried out, on 9 August 1955[†], just after two days of strong wind from the north* had brought about massive upwelling along the greater part of the eastern shore. On 7 August there were sharp rises and falls of temperature at intakes on the western and eastern shores, respectively. At Milwaukee and Racine, for example, Fig. 2. shows a rise of 15°F in 12 hours, with an even greater rate of fall in temperature (20°F in 6 hrs) at intakes on the eastern shore. As Fig. 2 is based on 6-hr means, the actual temperature changes must have been more rapid than the figure indicates.

[†] Ayers et al. 1958.

*The Lake appears to be particularly sensitive to winds veering from west to north, see Mortimer 1963.

The order of magnitude of commonly occurring rates of temperature change can better be assessed in Fig. 4, in which the intake temperatures are plotted, for the months of July and September 1963, as hourly readings, or hourly means derived from thermograph records. The greatest variability and the greatest rates of rise and fall were again found at the eastern intakes: Ludington, Muskegon, and South Haven, where rates of fall of 8°F per hour were not uncommon, while the rates of rise at these intakes were generally less. At the corresponding western intakes--from Waukegan northward--the rates of rise and fall were consistently less than on the eastern shore, values of 3°F per hour being typical. The variability at the southern end of the basin--Chicago and Michigan City--was considerably less than that further north.

The general conclusion is that temperature variability in beach zone waters is greatest at stations in the middle reaches of the lake (there are no intakes north of Rostok) and least at Chicago. In general, the rates of temperature rise and fall are highest on the eastern shore, where also the highest maximum temperatures are attained (and maintained for longer), for example, reaching a 1963 maximum of 75°F at Muskegon and Michigan City. During 1955 (Fig. 2) the temperature maxima were 80°F at Muskegon and 82°F at Benton Harbor and Michigan City. Maxima during 1955 at intakes along the western shore were some 8°F lower. There is considerable variation from year to year* both in timing and duration of upwelling periods (compare, for example, Figs. 2 and 4); but the high summer variability with rapid temperature changes is a persistent feature representing a randomly-occurring thermal stress to organisms in the beach zone waters. The occurrence of this stress is as unpredictable as the occurrence of the wind systems which cause the upwellings. With the sediment disturbance and high turbidity which follow onshore winds on long stretches of Lake Michigan shoreline, and with winter icing and the wide summer temperature range here described, the beach zone waters of Lake Michigan represent a biologically unfavourable environment and one in which the bottom fauna is generally relatively sparse.

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*I have assembled 20 years of summer records with the kind help of "pen friends" in various municipal filtrations plant.

The controlling influence of Lake-wide motions on inshore temperatures is confirmed by comparison between the intake temperatures illustrated in Fig. 4 and the cross-Lake temperature distributions illustrated for selected railroad ferry crossings from Milwaukee to Muskegon in Figs. 5, 6, and 7 (from Mortimer 1968). The upwelling and downwelling zones occupy, typically, near-shore strips of order 10 km width. Further offshore the influence of (near-inertial) internal waves is dominant. That the wave pattern is not confined to the cross-Lake section is demonstrated by Fig. 8, which shows not only western upwelling on two sections (compare Milwaukee and Sheboygan intake temperatures for 29 July in Fig. 4), but also (portions of) wave patterns in the N-S longitudinal section.

Up to this point, this note has dealt in facts relating to natural variations in Lake Michigan inshore temperatures. In conclusion, I offer a few

Comments prompted by a first reading of the report

The Report makes the commonly held assumption that power generation, now doubling approximately every decade, will continue to do so until the year 2000, i.e., an eight-fold increase over the 1970 figure. The Federal Power Commission, however, has not yet forecast beyond 1990. My own rough estimates up to that date (see Tables in appendix) are not at variance with those in the Report. They indicate that the Lake-wide effects will be small (for example, the only important Lake-wide effect appears to be that, by 1990, the water loss would increase by not more than 2% above natural evaporation, representing also about 2% of the mean Lake discharge), but that the main thermal effects will be concentrated locally. The crucial unanswered question is: "How locally?"

As the Report emphasizes, the added heat must pass through near-shore water before complete dissipation in offshore regions; and turbulent diffusion is usually the principal transport mechanism. The rates of turbulent diffusion will largely control the residence time of the added heat in the beach water zone. In appendix Table II this zone is defined as that bounded by the 10 m (33 ft) contour. A guess at a possible mean residence time of 10 days for the heat added to this zone yields an increase of 0.66°C above "ambient" averaged over the whole of the zone. The use, if any, of such an estimate is to indicate an order of magnitude only. The residence times and the amounts of heat added will vary greatly between one region of the beach water zone and another.

The greatest and most serious unknown is the magnitude and the variability, in space and time, of the eddy diffusion coefficients. That variation is certainly extremely wide; and this makes realistic modelling an almost intractable task. For example, we may visualize two extremes: one, case (a), in which an upwelling movement, of the kind described in this note, removes the whole inshore water mass from many miles of coastline in a few hours (see Fig. 3); and another, case (b), in which diffusion rates are low during a temporary minimum in inshore current activity, or during the early stages of a developing thermal bar.* Case (b) is, of course, the critical one for thermal loading; but, with present knowledge, prediction of its frequency or probable duration is highly unreliable.

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*The mechanism of the thermal bar, with a brief account of the historical development of the concept, is outlined in the appendix and Fig. 9. While it is likely to be an important factor in thermal loading of the Great Lakes, the thermal bar should not be looked upon as a nearly complete barrier to heat transfer (as the Report appears to suggest on p. 22). While the "bar" temporarily impedes horizontal mixing between the water masses on either side of it, there is continual mass (and heat) transport toward the convergence, and a downward transport of the mixed water mass to deepe4 regions of the lake is maintained (see Fig. 9b). It would be useful to have a rate comparison between the vertical transport in the thermal bar and horizontal transport by turbulence when the bar is not present.

In view of the difficulties outlined above, the Report cautiously assumes the worst case, thereby maximizing the "thermal stress" in the beach water zone.* The Report also attempts, again with proper caution, to list all the harmful ecological effects which present knowledge suggests might occur. Some of the suggestions on the list are necessarily speculative; but equally speculative advantages of added heat have not been considered (for example, enhancement of the capacity of the Lake for self-purification from the polluting wastes, which today pose a much more serious threat to the Lake's ecological health than do thermal additions).

My principal disappointment with the Report is that while it catalogs what might happen, it has not sought evidence (or recommended research to discover) what in fact has happened to the ecology of the Lake near the cooling water outfalls of existing large power plants. Some of these plants, of size-order comparable to the planned nuclear plants, present us with ready-made full-scale experiments which have been running for years. In view of present uncertainties and ignorance (both physical and biological) this is an opportunity which should not be passed by. A thorough study near such plants could lead most directly to realistic assessment of safe thermal limits, to criteria for siting new power stations well away from biologically sensitive areas, and to a well-informed public value judgment on this issue.

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*Its companion Report, U.S. Dept. of Interior (August 1970), "Feasibility of Alternative Means of Cooling for Thermal Power Plants near Lake Michigan" does not examine the possibility of piping the effluent two miles or more offshore to reduce thermal stress in the beach zone and to achieve better entrainment and dispersal. This possibility may also be worth considering in future for municipal sewage plant and storm water outfalls, which in favourable circumstances might be combined with power station outfalls.

The public is already paying heavily, in one way or another, for an astonishing multiplicity of research effort on "thermal pollution". Nevertheless, I would:

Recommend that an integrated effort be made to answer, through adequately planned and adequately equipped studies carried out on a year-round basis at selected existing Great Lakes power plants, the following questions: "What variations are there in patterns of heat dispersal in the Lake?" and "What influence have these patterns had on Lake ecology?" An answer to the first question will involve descriptions of the currents and the turbulent regime under different weather and Lake conditions, based not only on the dispersal of heat, but perhaps also on the dispersal of more conservative (chemical) properties, for example, the chloride input from major rivers, or controlled artificial additions. (For example, Dr. Ayers' studies of dispersal of river water in the Lake indicate, I understand, a comparatively high rate of turbulent dispersal.) An answer to the second question will involve control studies in regions not influenced by thermal addition. If this (applied) research program is adequately conceived to answer the above two questions, then it will also teach us a great deal we need to know about Lake Michigan.

C. H. Mortimer
24 September 1970

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Ayers, J.D., D. C. Chandler, G.H. Lauff, C.F. Powers, & E.B. Henson 1958. Currents and water masses of Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Publ No. 3, 169 p.

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APPENDIX

Tables I and II and Note on the "Thermal Bar" presented at the 2nd Annual Four-State Conference "Power Production and Protection of the Lake", sponsored by the Open Lands Project, at Zion, Illinois, 2 May 1970 (also embodied in a memorandum prepared for the Argonne National Laboratory entitled: "Electric Power Stations on Lake Michigan: A Simple Approach to Assessment of Physical Effects on the Lake", March 1970). Line 4 (power to be dissipated, 10^9 BTU's/hr) has been added for comparison with Table 8, p. 29, of the U.S. Dept. Int. 1970 Report.

Lake Michigan: Estimated thermal influence of electric power generation for the years 1970-1990, I.

	Units	1970	1975	1980	1990
Estimated electric power generated	10^9 w(e)	7	14	20	50
Assumed overall efficiency	%	30	33	35	40
Power to be dissipated	10^9 w(h)	16	28	37	75
Power to be dissipated	10^9 BTU's/hr	54	95	126	255
Daily equivalents: (i) Heat*	10^{13}g-cals				
(ii) Area and volume of "slab" of cooling water, 1 m thick raised in temperature by 10°C	km^2 10^{12}cm^3	33	58	76	154

w(e) = watts of generated electric power; w(h) = watts dissipated as heat.

*10^9w(h) = 10^3 Mw(h) = 2.06×10^{13} g-cal/day = 3.415×10^9 BTU's/hr.

Lake Michigan: Estimated thermal influence of electric power generation for the years 1970-1990, II.

	Unit	1970	1975	1980	1990
Power to be dissipated (cf. Table I)	10^9 w(h)	16	28	37	75
Daily equivalent heat input					
(i) whole lake surface (5.81×10^{14} cm^2)	g-cal/cm^2	0.57	1.0	1.3	2.6
(ii) inshore strip of depth ≤ 10 m*	g-cal/cm^2	7	12.5	16	33
Temperature rises, assuming 10-day storage:					
(i) whole lake volume (4.78×10^{18} cm^3)	°C	.0007	.0012	.0016	.0032
(ii) inshore strip of depth ≤ 10 m (2.3×10^{16} cm^3)	°C	.14	.25	.33	.66
Equivalent evaporation (per year)†					
(i) volume	10^{14} cm^3/yr	2.0	3.6	4.7	9.5
(ii) decrease in whole lake level	cm/yr	0.34	0.62	0.81	1.63
(iii) percentage of mean outflow (46×10^3 cfs)	%				2.3
(iv) percentage of natural annual evaporation (26 in)	%				2.5

* 8% of whole lake surface

† assuming all heat dissipation is through evaporation (590 g-cal/cm^3 at 10°C)

The Thermal Bar

The thermal bar convergence will probably turn out to be an important feature of the annual temperature cycle and nearshore circulation in all very large temperate lakes. It arises because, in such lakes, the inshore shallow waters cool off more quickly in the early winter and warm up more quickly in spring than do the deeper offshore waters. Thus, in late December and early January in Lake Michigan , inshore waters have cooled below the temperature of maximum density (4°C) while the offshore well-mixed deep waters still remain slightly above that temperature. Forel (1895) was the first to observe (in the Lake of Geneva, Switzerland; see his schematic representation in Fig. 9a) that, in the mixing zone between the inshore and offshore water masses, the mixture (at maximum temperature near 4°C) is denser than either of the component water masses; and it consequently sinks. The conversity of the curve relating temperature and density of pure water, with a maximum at 4°C, shows why this should be so.

The sinking mixed water mass is replaced by surface convergence of more inshore and offshore water, leading to continued mixing and sinking. This convergence mechanism, recognized by Tikhomirov (1963) both in spring and early winter in Lake Ladoga (Fig. 9b), acts as a temporary thermal barrier to horizontal exchange between nearshore and offshore water masses. The thermal bar is most strongly developed in spring and early summer and forms a sharp division between stratified water with high surface temperatures inshore and unstratified water below 4°C in the deep offshore regions.

As spring heating continues, the thermal bar moves progressive offshore until stratification is established right across the Lake (Fig. 9c, after Rodgers, 1966). A similar sequence of events during spring will probably be found in Lake Michigan, first in the southern half and later in the northern half of the basin; and Fig. 9d (Church, 1945) probably represents the aftermath of a thermal bar in the northern half of the Lake.

Currents induced by the thermal bar have components parallel to the shoreline and normal to the shoreline (i.e., toward the convergence); and there are also (smaller) descending currents in the convergence (Huang, 1969).

References (Thermal Bar)

Church, P. E. 1954. The annual temperature cycle of Lake Michigan (II): Spring warming and summer stationary period, 1942. Misc. Rept. No. 18, Inst. Meteorology, Univ. Chicago (Univ. Chicago Press).

Forel, F. A. 1895. Lac Léman. Monographie Limnologique, Vol. 2 (Paris), 651 p.

Huang, C. K. 1969. The thermal current structure in Lake Michigan, a theoretical and observational model study. Univ. Michigan, Great Lakes Res. Div., Spec. Rept. No. 43.

Rodgers, G. K. 1966. The thermal bar in Lake Ontario, spring 1965 and winter 1965-66. Proc. 9th Conf. Great Lakes Res., Univ. Michigan, Great Lakes Res. Div., Pub. No. 15: 369-374.

Tikhomirov, A. I. 1963. The thermal bar in Lake Ladoga. Bull. (Izvestiya), All-Union Geogr. Soc., 95: 134-142 (Amer. Geophys. Union Translation, Soviet Hydrol., Collected Papers No. 2).

Legend to the following Figure 9. The Thermal Bar: (a) in winter in Lac Léman (Forel, 1895); (b) in spring and winter in Lake Ladoga (Tikhomirov, 1963); (c) formation and development in Lake Ontario (after Rodgers, 1966); (d) aftermath of a thermal bar in June in northern Lake Michigan (Church, 1945).
[Fig. 9b is attributed to Tikhomirov in S. V. Kalesnik's book "Lake Ladoga," Leningrad, 1968.]

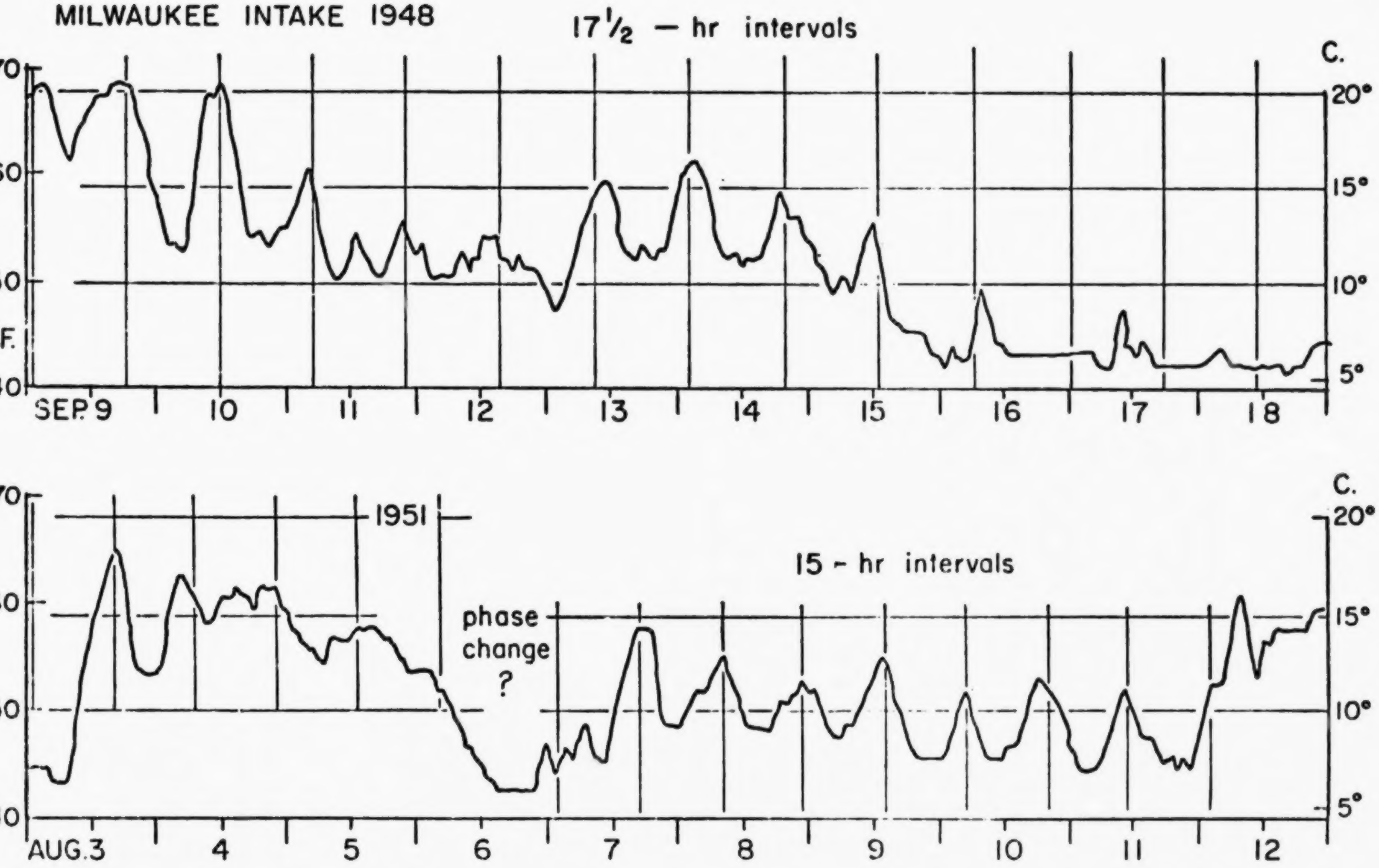


Fig. 1. Water intake temperature records for Milwaukee, Wis. (hourly means in °F extracted from thermograph charts) showing the influence of internal waves of near-inertial frequency.

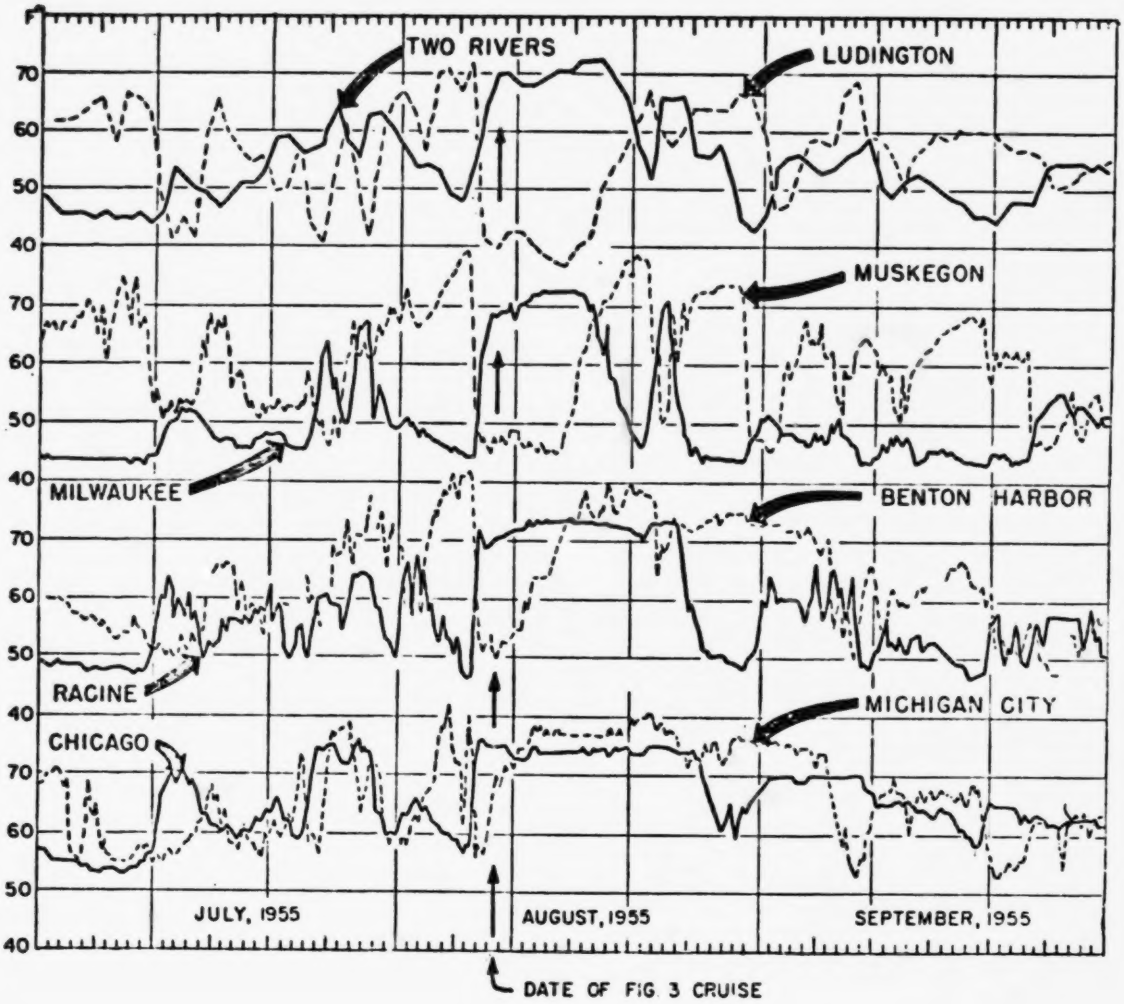


Fig. 2. Temperatures, °F, at the following municipal water intakes (July to September 1965): Two Rivers, Wis. (35); Ludington, Mich. (45); Milwaukee, Wis. (55); Muskegon, Mich. (50); Racine, Wis. (29); Michigan City, Ind. (38). The numbers in brackets indicate the depth of the intake in feet below the lake surface. The above graphs represent 6-hr mean temperatures, prepared from thermograph records or from other readings, except for Two Rivers and Ludington, for which only daily readings were available.

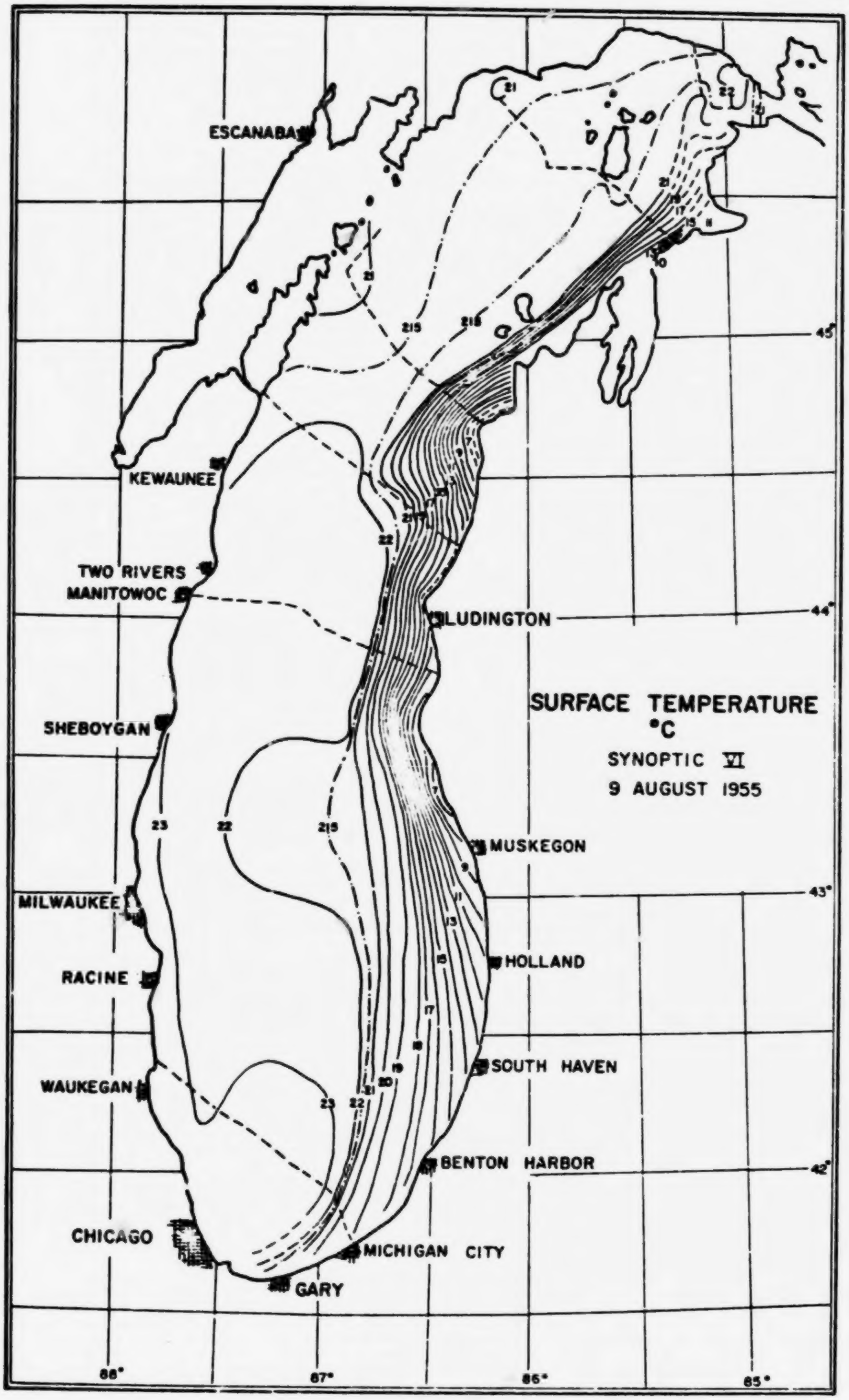
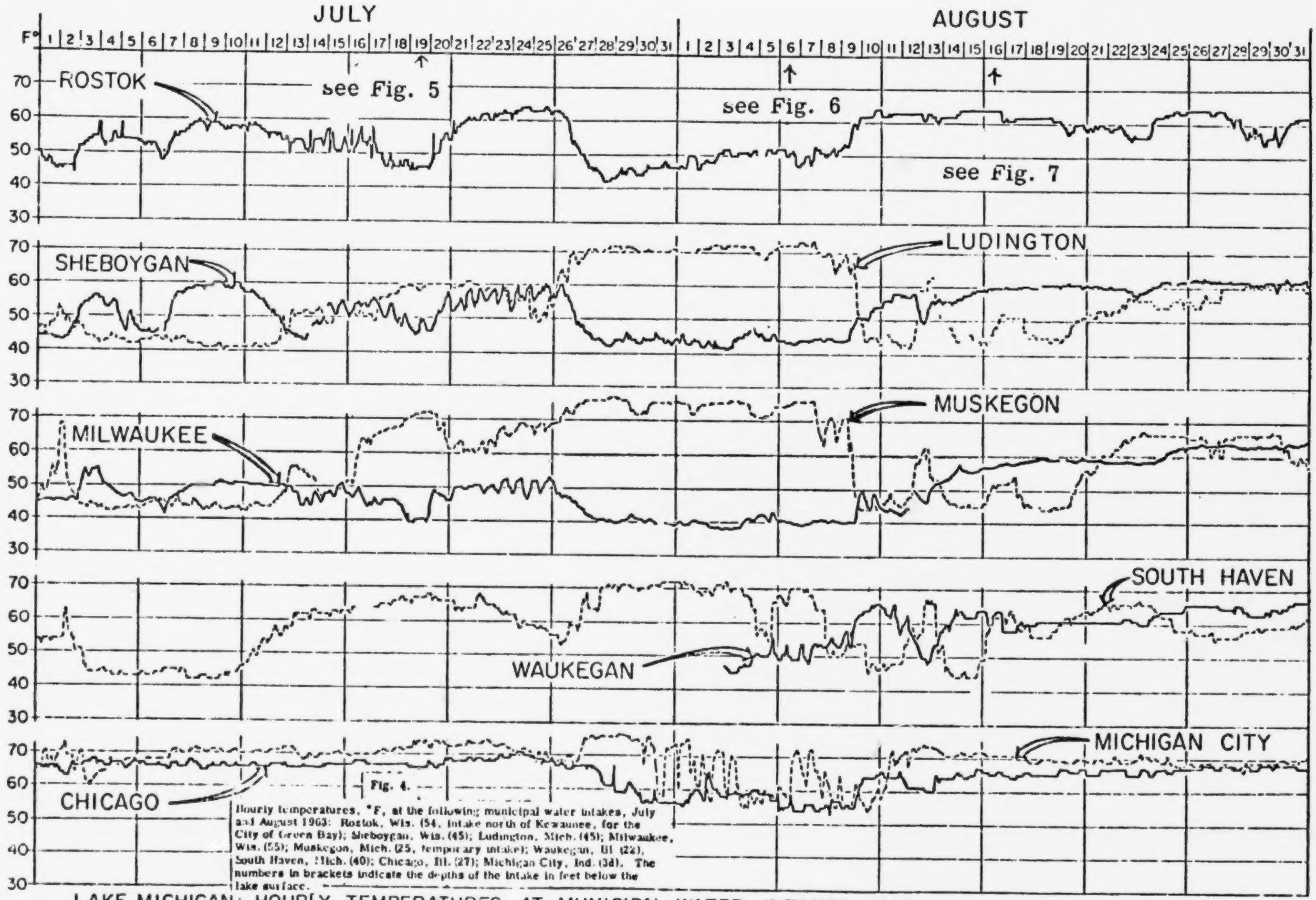


Fig. 3. Lake Michigan surface temperature, °C, 9 August 1955, based on a multi-ship survey (Ayers et al. 1958). The corresponding temperatures at the coastal water intakes are shown in Fig. 2.



see Fig. 5

see Fig. 6

see Fig. 7

Fig. 4.

Hourly temperatures, °F, at the following municipal water intakes, July and August 1963: Rostok, Wis. (54, intake north of Kewaunee, for the City of Green Bay); Sheboygan, Wis. (45); Ludington, Mich. (45); Milwaukee, Wis. (55); Muskegon, Mich. (25, temporary intake); Waukegan, Ill (22), South Haven, Mich. (40); Chicago, Ill. (27); Michigan City, Ind. (38). The numbers in brackets indicate the depths of the intake in feet below the lake surface.

LAKE MICHIGAN: HOURLY TEMPERATURES AT MUNICIPAL WATER INTAKES 1963

Figure 4.

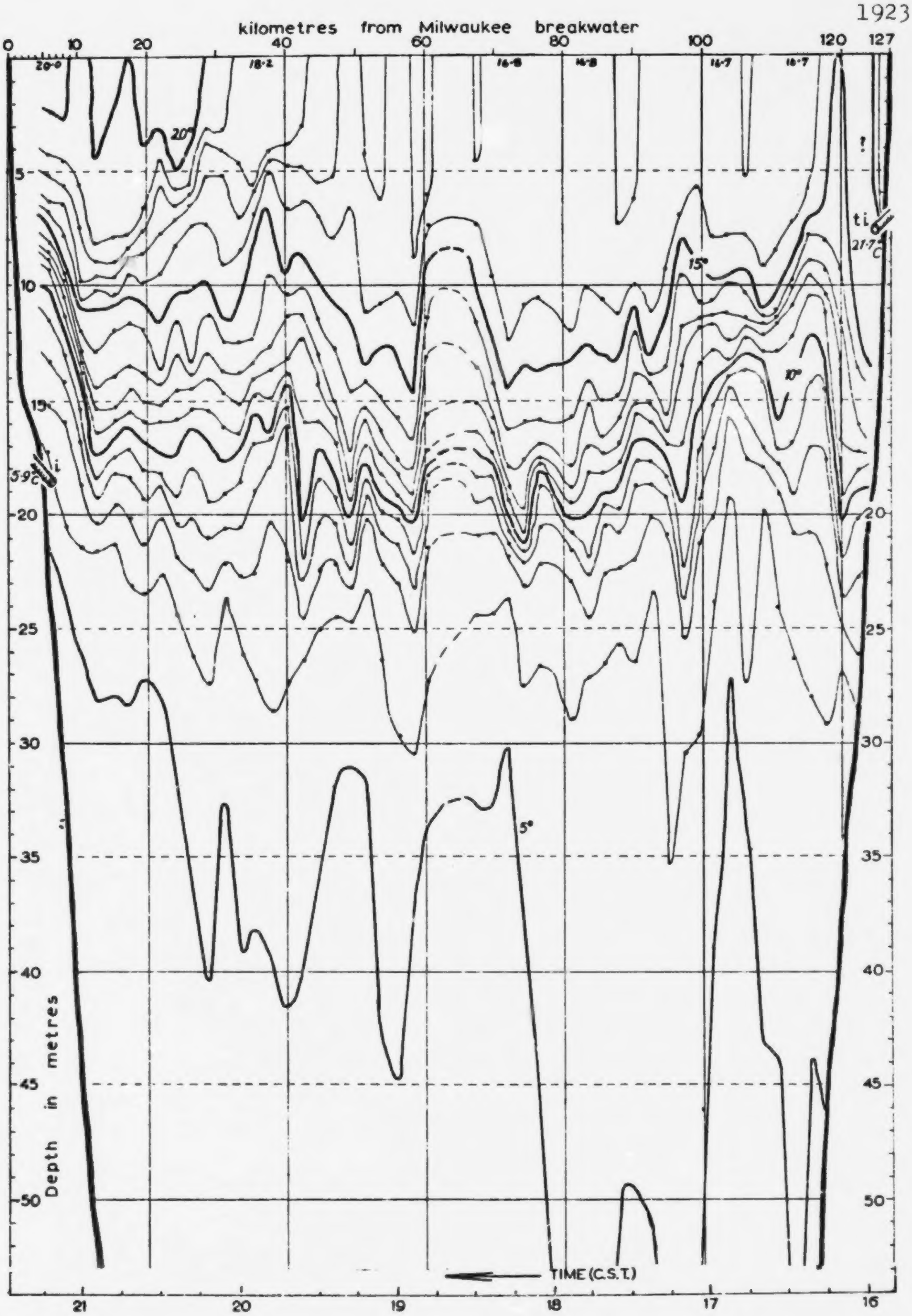


Fig. 5. Lake Michigan 1963: Distribution of temperature, °C, in the Milwaukee-Muskegon section (selected from a series obtained on railroad ferry crossings, Mortimer 1968), Run. No. 164, 19 July.

1924

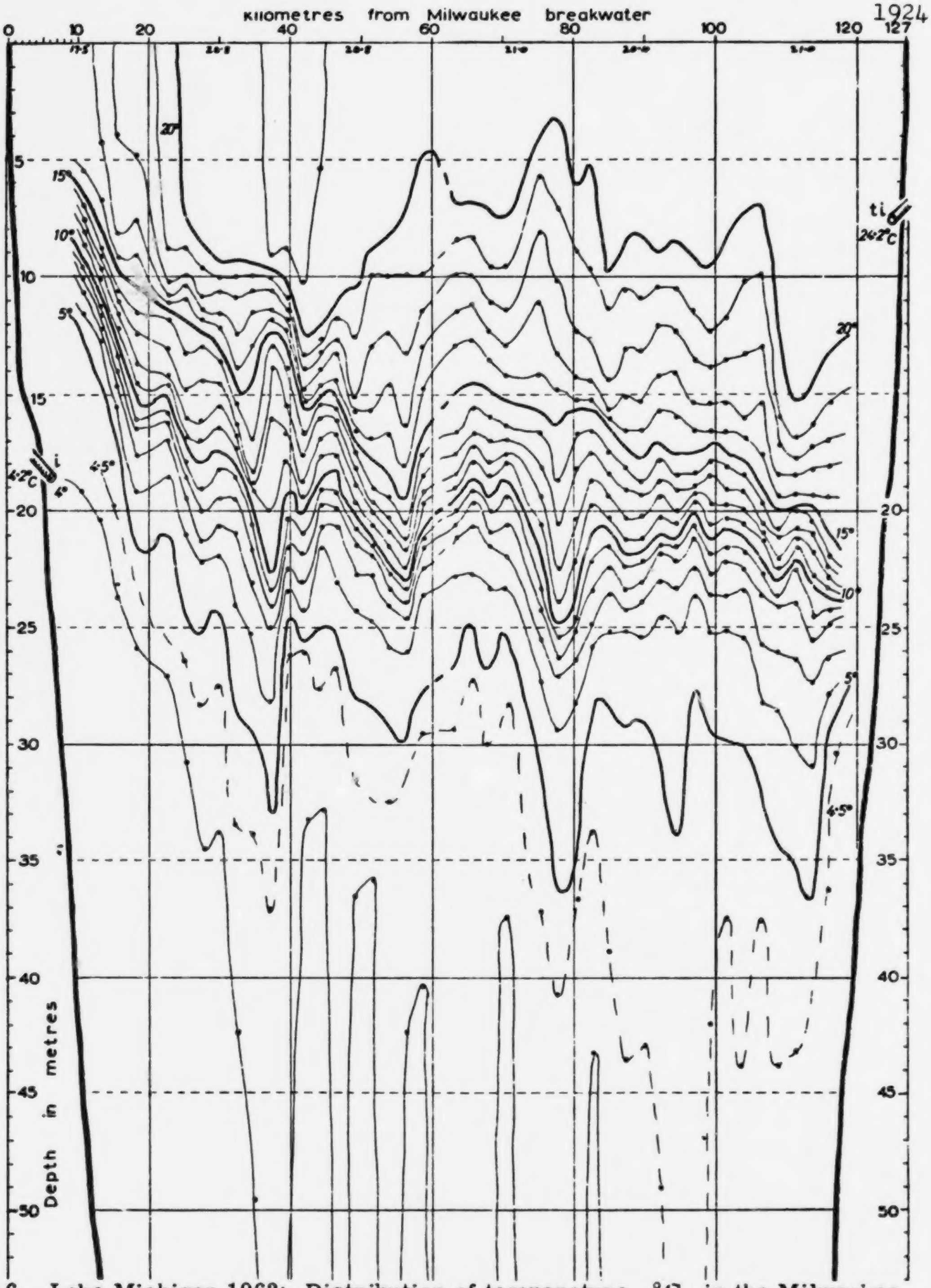


Fig. 6. Lake Michigan 1963: Distribution of temperature, °C, in the Milwaukee-Muskegon section (selected from a series obtained on railroad ferry crossings, Mortimer 1968), Run. No. 192, 6 August.

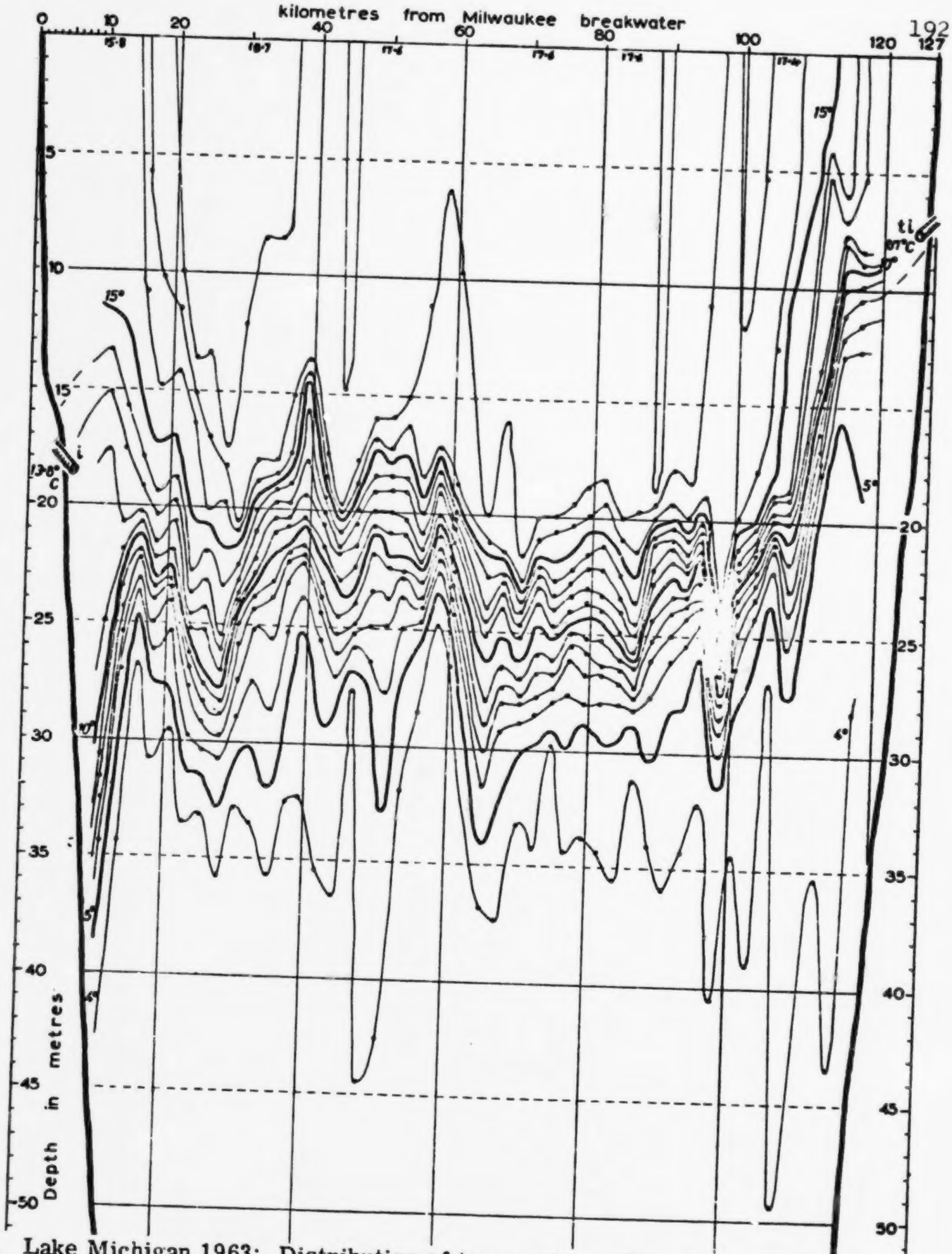
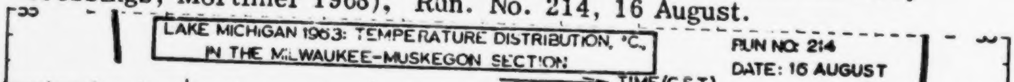


Fig. 7. Lake Michigan 1963: Distribution of temperature, °C, in the Milwaukee-Muskegon section (selected from a series obtained on railroad ferry crossings, Mortimer 1968), Run. No. 214, 16 August.



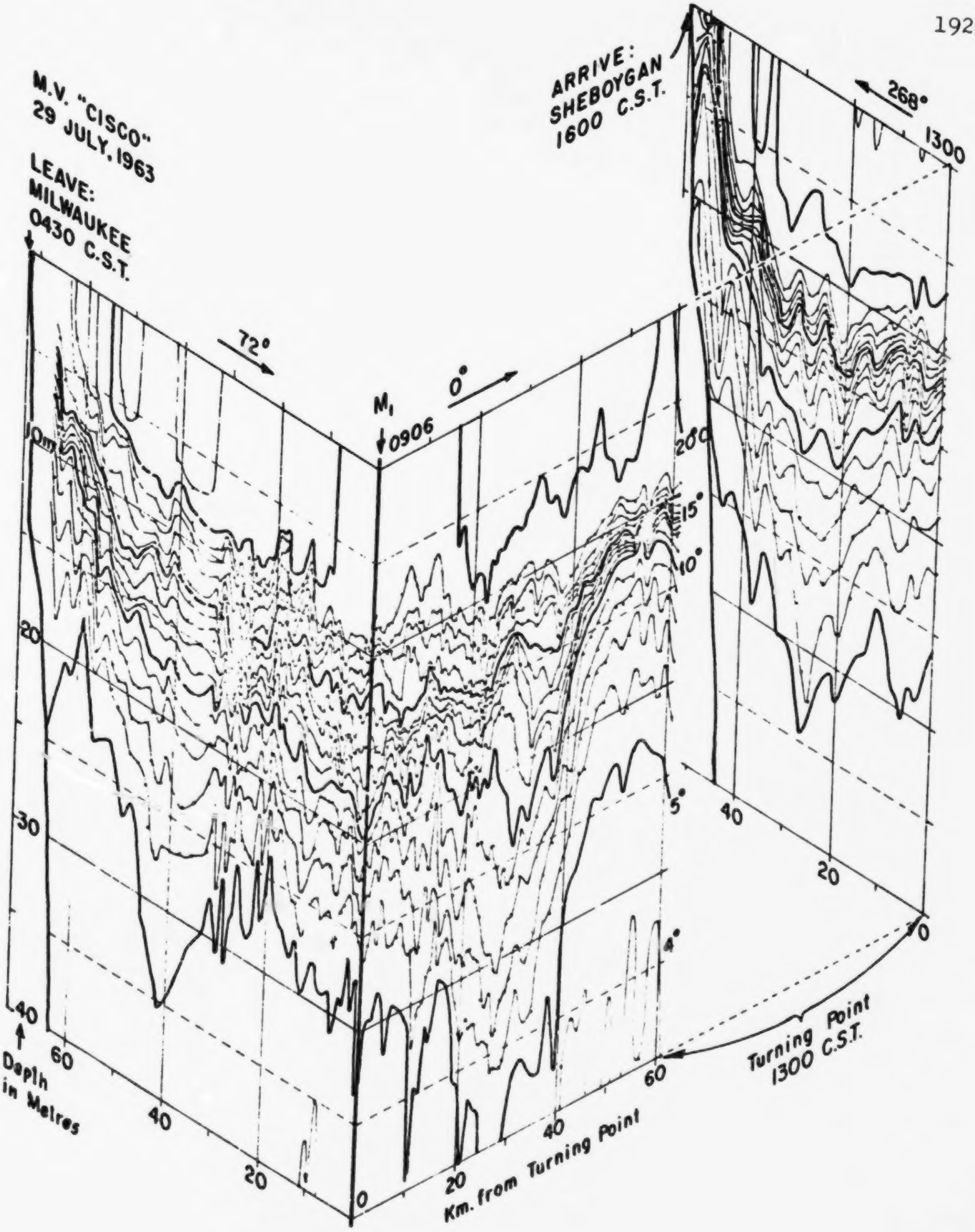


Fig. 8. Lake Michigan 1963: Distribution of temperature, °C, along the cruise path of R/V "Cisco" on 29 July, from Milwaukee to mid-Lake, then north for 16 km. then west to Sheboygan. Isometric projection; direction in degrees (true).

The thermal bar.

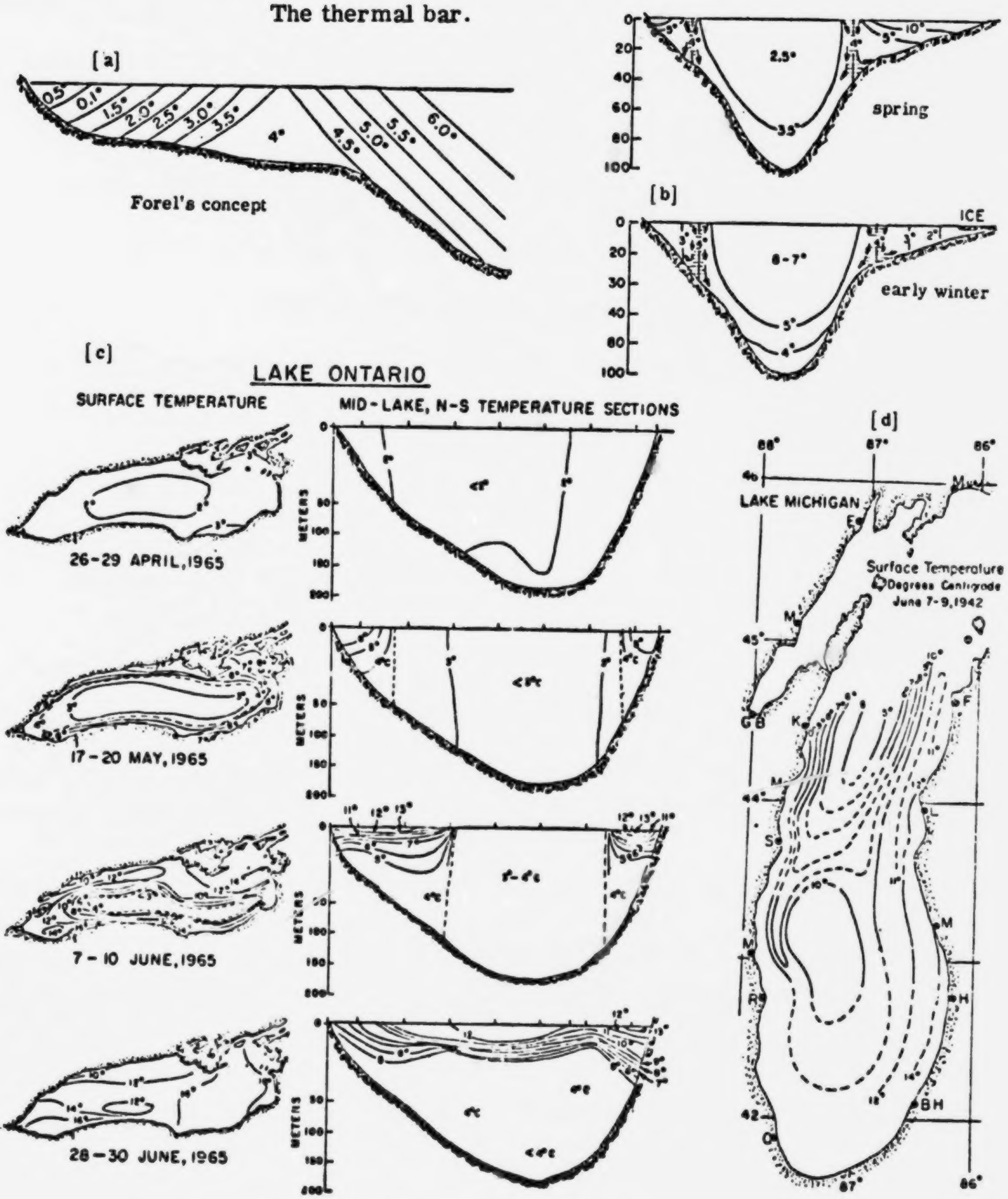


Figure 9. The thermal bar.

MR. STEIN: Let's reconvene.

William Singer.

MR. SINGER: I prefer to wait for the conferees.

MR. STEIN: You may have to wait a long time.

MR. SINGER: I have waited since 9:00 o'clock. I think it is rude to ask someone to testify when there is no one here to listen. I have waited since 9:00 o'clock. I would rather not testify until the conferees are here to listen.

MR. STEIN: Dr. Sobota.

STATEMENT OF JOSEPH T. SOBOTA, M.D.,
PRESIDENT, TEMP, KALAMAZOO, MICHIGAN

DR. SOBOTA: Chairman Stein, the Federal Water Quality Administration, the Bureau of Commercial Fisheries, the Bureau of Sports Fisheries and Wildlife, members of the Lake Michigan Enforcement Conference, and ladies and gentlemen of the public. My name is Dr. Joseph T. Sobota. I live at 2312 Glenwood Drive, Kalamazoo, Michigan, and I am speaking on behalf of myself and Mr. Ron McCandlis, 5619 Clato Street, also of Kalamazoo. I am Executive Director of TEMP (Thermal Ecology Must be Preserved); Mr. McCandlis is President of the Michigan Steelhead and Salmon Fishermen

Association. More importantly, we represent the public in a contested Atomic Energy Commission hearing concerning the Consumer Power Company's Palisades Nuclear Plant in Covert, Michigan. The Michigan Lakes and Streams Association and the National Sierra Club have joined us in this AEC hearing being held in Kalamazoo, Michigan.

Mr. McCandlis and myself, as citizens of the State of Michigan, are represented by the Michigan Water Resources Commission with regard to water pollution problems. In 1967 this Board gave an order of water use determination to Consumers Power Company allowing them to prospectively operate the Palisades Nuclear Plant, in spite of this plant's planned normal operation of dumping daily into Lake Michigan 561,000,000 gallons of water heated 28 degrees Fahrenheit above normal lake temperature. No reconsideration of this order was made in the intervening years, even though much new substantial evidence of thermal pollution connected with nuclear powerplants has since been developed, some of which you heard in the earlier parts of this morning.

In March 1970, the AEC gave notice in the Federal Register of its intent to license this plant unless parties whose interest would be affected intervened. At this time, the State of Michigan remained without water temperature standards approved by the Department of the Interior. In turn, the Department of Interior had neglected to promulgate regulations of thermal input into the essentially Federal Lake Michigan.

This dual vacuum of inactivity by the Department of Interior and the Water Resources Commission in failing to set thermal standards provoked our intervention April 2, 1970. Our petition for a public hearing included the request for implementation of the National Environmental Policy Act (NEPA) as a vehicle for coordination of AEC, Department of Interior, and Water Resources Commission consideration of thermal pollution in Lake Michigan. A determination on thermal pollution in an AEC hearing on nuclear plant licensing would affect not only the Palisades Plant but would serve as a precedent to the many other plants of this variety planned or actually under construction on the shores of the lake.

The hearings began in Kalamazoo June 23, 1970, and are still in progress. In these hearings the Atomic Energy Commission staff and the applicant, Consumers Power Company, have by legal maneuvering attempted to avoid the topic of thermal pollution and the effect of the Palisades and similar nuclear powerplants' total impact on Lake Michigan. Until as recently as September 25, 1970, they have been eminently successful in preventing such discussions.

J. T. Sobota

Through the brilliant legal representation of Mr. Myron Cherry, our attorney, the AEC Safety and Licensing Board in session in Kalamazoo referred to the Atomic Safety and Licensing Appeal Board in Washington the following September 3 ruling for judgment:

"The ruling that the National Environmental Policy Act ... requires the Staff of the Commission to transmit the application of Consumers Power Company (Palisades Plant) to the several agencies of the Government for comments respecting the environmental considerations enumerated in said Environmental Act. In addition, the ruling requires the Staff to prepare an environmental policy statement based upon the comments submitted by the several agencies of the Government and direct it specifically to the items enumerated in the Environmental Policy Act."

In other words, the Safety and Licensing Board in Kalamazoo asked that the Consumers Power Company and the AEC staff, under the requirements of the National Environmental Policy Act, consult with all concerned agencies of the government, both State and Federal, regarding the ecological impact of the Palisades Nuclear Plant and the other nuclear plants in the lake basin.

The Appeal Board in its answer docketed September 25, 1970, No. 50-255, essentially said that this type of report is not necessary for a one-megawatt license, but is necessary for a full power license.

This is the first such implementation of questions outside those of radioactive consideration to be addressed by the AEC. After 4-and-one-half months of tedious, difficult and considerably technical matters, our strategy of using the National Environmental Policy Act as a vehicle of introduction of thermal pollution at an AEC hearing had paid dividends. The opportunity now exists, through the AEC, to circulate the Palisades Nuclear Powerplant license and an environmental report of the ecological impact of this plant for comment to all appropriate Federal agencies which might have expertise in this matter, so that this will be addressed to you gentlemen now at this meeting.

We interpret this ruling as opening the door for a significant participation by the Department of Interior in respect to this licensing activity. Since the State of Michigan has no thermal standards and since the Department of Interior, through the agencies represented here (Federal Water Quality Administration, Bureau of Commercial Fisheries and the Bureau of Sports Fisheries and Wildlife) has recommended a one-degree limit of heat input at the point of discharge in its excellent report presented at this meeting, we maintain that the Interior Department has the only guidelines available for licensing this plant and any other nuclear plant on Lake Michigan's shoreline. The Appeal Board ruling specifically states:

"The determination (under NEPA) as to whether an action constitutes a major Federal action significantly affecting the quality of the human environment is one to be made by the agency proposing or authorizing the action; and we find this confirmed in the relevant legislative history. As to the matter of making the determination, we find nothing in NEPA which would preclude agencies from implementing this responsibility as they implement others, through the issuance of regulations which treat the categories of agency actions."

Since the State of Michigan has no thermal standards for Lake Michigan, and while the Department of Interior has no regulations, the only valid documents or guidelines by the Interior Department are the ones submitted regarding the 1-degree limit for heat input into Lake Michigan at the point of emission.

In a matter of weeks, the environmental report of the Consumers Power Company and the Palisades licensing application will be forwarded to you gentlemen representing the Department of Interior and the State agencies here. On the strength of your report submitted here entitled

"Physical and Ecological Effects of Waste Heat on Lake Michigan," the AEC will have no choice but to enter in testimony regarding thermal pollution at the hearing, and to resolve the considerations under which this plant will dispense heat into Lake Michigan.

This is the way that the regulations and the guidelines will be implemented in an action that demands decision at this instant. These hearings are being held at this instant.

I urge you to immediately request the license and the environmental report from Consumers Power Company, and immediately notify the AEC Hearing Board regarding Docket No. 50-255 of your eminent participation in this hearing on the matter of thermal pollution. It is within your power now, on the basis of the AEC's own ruling, to so participate and effectively promote the conclusions stated so well in the previously cited paper "Physical and Ecological Effects of Waste Heat on Lake Michigan." The Department of Interior must utilize this opportunity to either promulgate a protective thermal standard without a pollution coefficient and actively participate in the current AEC decision-making hearings, the Palisades hearing in Kalamazoo, Michigan, in particular, or the significance of this conference will be nothing more than a fraudulent exercise of public appeasement.

The Department of the Interior can now assume, to a great extent, the responsibility abdicated by the Water Resources Commission of the State of Michigan for the past documented 32 months. As far back as January 1968, the distinguished former Secretary of the Interior, Stewart Udall, in a letter to the then Governor Romney of Michigan, stated, "I am at this time excepting (Department of Interior) ... approval of temperature parameters as these apply to the (fish, wildlife, and other aquatic life) water use for all interstate waters covered in the Michigan State's original and supplemental standards submissions, including the waters of the Great Lakes. I believe that further discussions regarding these temperature parameters are necessary, and I am instructing my people to contact your officials without delay to begin working out such modifications as would afford great protection to this important water resource use. I would greatly appreciate your cooperation in this matter, and I remain confident that our mutual efforts will result in modified temperature parameters which I can approve." This letter was written January 1968.

The Michigan Water Resources Commission has still not proposed temperature standards which are acceptable to the Department of the Interior. Is this the type of inaction to be expected from a responsible representative group?

The responsibility also has been abdicated by Consumers Power Company management. While they consistently live within the letter of the law, they maintain public and hearing positions which are contradictory. Publicly Consumers Power Company maintains that no thermal pollution will occur with the Palisades Nuclear Powerplant. In the Atomic Energy Commission hearings in Kalamazoo, however, they have legally briefed against hearing in an administrative process their scientific proof and substantial alternate scientific opinion on thermal effects such as the concise paper just submitted by the Interior Department, and remarks by eminent scientists like Dr. Don Pritchard. We may surmise something of the soul of Consumers Power Company management from tactics of the type just cited. Apparently, in the area of thermal pollution where anti-pollution controls are feasible and available and documented, Consumers Power Company management has arbitrarily decided not to provide the power of the Palisades Nuclear Powerplant to the citizens of Michigan, rather than add one of the available and feasible means of cooling the nuclear powerplant water effluent.

J. F. Sobota

The organizations I represent have always operated within the established rules of practice of the Atomic Energy Commission, and other legal restraints that we are obligated to work under. Delays of the plant in no way add substance to our organization's aims. Our position as simply stated is additional power supply to Michigan without pollution. We refuse to accept a utility company's promise that any harmful effects to the environment caused by a nuclear powerplant would be taken care of if and when any occur.

I would like you to remember the earlier presentation of the algae in Little Traverse Bay. That was interesting news to me. I would like to know now what material action will be taken to cure that if, in fact, it is secondary to the Charlevoix big water plant.

While maintaining this posture, utility companies neglect to define "harm" and exactly what action they would take if such future damage occurred.

We are not willing to play Russian roulette with Lake Michigan. We have no evidence historically, scientifically, nor can we deduct intuitively, that damage once it occurs to the lake is reversible. Also, in view of this fact, we must be on guard to prevent plants of the Palisades type from gaining a vested interest by mere active operation, enabling them to hide behind grandfather clauses, such as those which exist in the Federal Water Quality Act of 1970.

Accommodation to pollution is an abomination which should not be tolerated by anyone in this room charged with protecting the public interest. This applies as much to power company representatives as to Federal and State representatives. While the power companies must live within the letter of the law, and they do, we charge them to live within an enlightened outlook in an unpolluted world.

In summary, the organizations I represent have acted in a novel way to introduce the implementation of thermal standards in an AEC hearing of a license to operate a nuclear powerplant on Lake Michigan. The legal ruling established in this hearing to date now affords the Department of Interior the opportunity to act directly, with guidelines and regulations, in areas such as the State of Michigan, where no thermal standards exist, as an active participant in forming the licensing stipulations which will be in effect for the operation of such plants.

We charge them to act in a responsible manner at the Palisades nuclear power hearing now under way in Kalamazoo, Michigan. This action will serve as a precedent to all other nuclear power facilities in the Great Lakes

Basin and effectively implement the guidelines which were so well presented by the Department papers released at this conference. Successful participation on the part of the Department of Interior, or better yet, responsible action by the Water Resources Commission of the State of Michigan, would provide the national precedent needed to blunt massive thermal pollution threatened by a rapidly growing nuclear power industry.

Thank you very much. (Applause)

MR. STEIN: Thank you, Dr. Sobota.

Any comments or questions?

MR. FETTEROLF: Yes.

Dr. Sobota, at the meeting of the Michigan Water Resources Commission held on October 27, 1966, the order of determination was adopted relative to Consumers Power Company, Palisades Plant. This was before temperature standards were required, and in the absence of temperature standards I would like to read you Section 6 of that order which states: The company shall not impart heat nor contain any substances in sufficient quantity to create conditions which are or may become injurious to the public health, safety, or welfare, or which are or may become injurious to domestic, commercial, industrial, agricultural, recreational, or other uses which are being made of such waters, or which are or may become injurious to the value or utility of riparian lands, or which are or may become injurious to livestock, wild animals, birds, fish or aquatic life, or the growth or propagation thereof.

In Section D of this order of determination, it states: The company shall make measurements of wastes discharged to Lake Michigan and shall perform such analyses as are necessary to demonstrate that the requirements of this order are being met. Reports of such analyses and measurements shall be available for inspection by authorized employees of the Water Resources Commission, and an annual report thereof shall be submitted to the Commission by the company.

With respect to --

DR. SOBOTA: May I answer that statement, please?

I have read that statement, and I would like to again go back to the text of my remarks and substitute "utility companies" for the Water Resources Commission. While maintaining the posture in that document which is so elegantly stated, the Water Resources Commission and the companies have failed or neglected to find harm in exactly what action they would take if such actual damage occurred.

Now, without the possiblity of using measuring sticks for decision-making, and language of that type, I doubt whether, in fact, anything could be said other than a very nice-sounding rhetoric to that statement. (Applause)

MR. STEIN: Any other comments or questions?

MR. FRANGOS: Mr. Chairman, do we have copies of that presentation now for the conferees?

DR. SOBOTA: I have a certain number of copies available. I don't know whether there will be a sufficient number for all of the members of the conference.

MR. STEIN: Why don't you bring up the ones you have?

Mr. Petersen.

MR. PETERSEN: Thank you, Mr. Chairman. O. K. Petersen.

Dr. Sobota, I understand you are a medical doctor?

DR. SOBOTA: Is that a question?

MR. PETERSEN: Is that correct?

DR. SOBOTA: Yes, I am a physician. I specialize in pathology.

MR. PETERSEN: Are you also a lawyer?

DR. SOBOTA: No, I am not.

MR. PETERSEN: Then your comments as to the State of Michigan not having standards in effect as to Lake Michigan are your conclusions as a doctor rather than as a lawyer?

DR. SOBOTA: They are my conclusions as a physician, as an interested party in these hearings, as an active participant in the intervention in a nuclear plant, and as a citizen.

MR. PETERSEN: Are you aware that such standards were adopted even if they were not approved by the Department of the Interior -- Secretary of the Interior -- correction.

DR. SOBOTA: I understand that there were standards that were attempted to be promulgated, but were consistently denied approval by the Department of Interior, yes.

MR. PETERSEN: Is it my understanding that if Consumers Power Company should put up cooling towers at the Palisades plant that you would have no more difficulty with the plant, and you would withdraw your opposition to the licensing of that plant?

DR. SOBOTA: We would like to discuss that possibility with the Consumers Power Company.

MR. PETERSEN: Then, when you say you would like to discuss the possibility, you are not saying that is the standing of your group?

DR. SOBOTA: Our standing is that we would like to protect the ecology surrounding that plant, and protect the impact of heat dissipation from multiple nuclear plants on Lake Michigan by whatever feasible means are available for antipollution devices that would be attached to such a set of plants.

MR. PETERSEN: When you said here that Consumers Power Company had deprived the people of Michigan of that electricity instead of putting up cooling towers or taking other cooling action, you were not stating your entire case, were you?

DR. SOBOTA: What I was stating there is that Consumer Power Company management because of whatever policies might have been the basis of the foundation for designing and implementing the use of that plant had not put on that plant feasible antipollution devices, and because of that particular problem, and because of the void of standards -- thermal standards both by the Federal and by the State Government, certain citizen groups adopted a policy of intervention so that these questions would be answered properly before the operation of that plant began.

It is a 40-year plant, and the operation of such a plant, in the face of unknown irreversible damage to a lake, and at a time where it may become a precedent-setting plant and license for all of the plants around the

Lake Michigan basin was also some of the reasoning for the intervention in that particular plant by conservation groups.

MR. PETERSEN: Your theory, then, is to oppose this plant at this stage of operating after it has been built instead of opposing future plants on a construction basis, as you did not oppose this plant when it was being constructed.

DR. SOBOTA: We do not oppose this plant, and I think I want to make that very clear. AEC has seen fit not to license this plant until after a hearing of all of the issues involved in the safety, in the performance evaluation of the plant, and in the other considerations that are made for the licensing of such a plant. It is the AEC, in fact, that has not given you an operating license.

MR. PETERSEN: Did you or any of your group oppose the construction license for this plant?

DR. SOBOTA: I was not in the State of Michigan at that time. We were not even formed at that time as far as an organization. But I must say we probably do have a much quicker reaction time especially in view that we understand technology races along and may leave the decisions behind before adequate decisions could be made. And in that regard we did act rather decisively and quickly after we had analyzed the data that were available to us and also to the conferees at this conference, and also to the Water Resources Commission of the State of Michigan.

MR. PETERSEN: I take it your answer is no.

DR. SOBOTA: We did not participate in the construction or permit hearing which was rather perfunctory, after reading the transcript, because of the absence of both my personal presence and the absence of organizations concerned with this problem at that time. (Applause)

MR. PETERSEN: Thank you very much.

MR. STEIN: Thank you.

May we have Alderman William Singer?

STATEMENT OF WILLIAM S. SINGER, ALDERMAN,
43rd WARD, CHICAGO, ILLINOIS

MR. SINGER: Mr. Chairman and members of the conference. I am pleased to have the opportunity to appear before this Third Session of the Lake Michigan Enforcement Conference and to testify regarding the proposed standard before you at this time which would provide that "... no significant amounts of waste heat ..." be discharged into Lake Michigan.

W. S. Singer

Today you will hear testimony from the public on this proposed standard and it is a fair guess that the testimony will be relatively uniform in favor of your adoption of this standard. This is no secret, but it occurs to me that it is fair to go beyond the mere unanimous public support for this proposed standard and probe the reasons for this public support.

First, it must be abundantly clear that the people of the States surrounding Lake Michigan fear its ultimate death within this decade. The Lake Erie tragedy and the constant reports of the eutrophication of our lake has justifiably alarmed residents of the four States bordering Lake Michigan.

Second, against this background of fear is a total lack of trust and unwillingness to go further with those who have polluted the lake for too many years. Industry now says, "Give us a few plants and some more time." And the public says, "Damn your time" -- and rightly so.

What basis is there for trust when day after day the pollution of the lake continues primarily through the efforts of industry? The simple fact is that industry does not deserve our trust.

Third, the public has seen too many examples of "Try now, pay later." Drugs have been placed on the market with insufficient testing, with often disastrous results. Pollution of our environment has been caused by any number of devices or products which the public was told would help create "the better life." The public has paid dearly for the better life and, indeed, if the same processes continue, the end of the better life may be around the corner.

Fourth, and perhaps most important, the public knows what our science and technology can do if pushed far enough. I would add here that the intent of this statement is that it knows that the plants can continue their operation without thermal discharge; it knows it because even the industry has said that there are alternative means such as cooling towers, circulation systems. The powerplants on the lake are the path of least resistance, economically speaking, for the industry. The proposals to use lake water and to discharge it at substantially higher degrees are similarly the path of least economic resistance.

I understand that one witness has stated that the proposal before you "is economically unrealistic." Economically unrealistic to whom? To the public? No, it is economically unrealistic, or stated perhaps more accurately, less advantageous to the power industry. But it is quite realistic to the public who will have to pay if thermal discharges are found to be harmful to the lake.

Gentlemen, no one of us can ever accurately reflect total public sentiment on any issue, but on this proposal there can be little doubt that the public does not want to take any more risks with the future of the lake. They don't trust industry and they know that time is short. It is unacceptable, as one power company spokesman has suggested that it might be, to let the plants go ahead and then we can test to determine if there is damage. But that same spokesman has said that if after a year of study damages did occur, it might take 2 or 3 years to change the processes and eliminate the thermal discharge. That means a period of almost 4 years during which time the thermal discharges would continue unabated. Can we afford any chance like this with Lake Michigan?

The public, I believe, says that we cannot, and is asking you to say to industry that there will be no more chances. It is asking you to say no thermal discharges. I urge you to adopt such a strict standard at this session of the conference before it is too late.

Let me add: It occurs to me that another public reaction might be gleaned from the testimony before you today of the seeming confusion that might result if one were to ask, as you have, who and in what period of time will come forth with a standard which will be effective to stop any possible damage to Lake Michigan resulting from thermal discharges? Who? Is it you as a conference? Is it the Department of Interior? Is it each individual State? The public doesn't really know, and I must say I doubt you gentlemen know what the fastest way to achieve that standard is.

But you gentlemen, collectively or individually through your own States, have some power, and the decision ought to be to exercise it as fast as possible even if it means adopting a standard and promulgating a standard for your individual States which may only be an interim one, because an interim one will at least give the public assurance that not until there is a clear and demonstrated -- it is clear and demonstrated that no harm will result will thermal discharges be permitted.

If you want to label it "interim," fine, make this clear, too: It will be interim until the industry has made its case clear. And I suggest that if the public is going to have any confidence in the political process in terms of ending or turning around the process of eutrophication of Lake Michigan, indeed all over this country, if they are going to have that confidence in the political process, then you gentlemen have it within your power to do something about it soon.

We cannot continue the game of "Whose back is the monkey on?" You can do it individually or collectively -- I don't care which -- but I urge you to do it.

Thank you very much. (Applause)

MR. STEIN: Thank you, Alderman Singer.

Any comments or questions?

If not, may we have Mrs. Louise Erickson?

While she is coming up, I have several telegrams which I would like to put in the record as if read, and the statement of the Elk River Drainage Basin Council, submitted by Mr. Ted F. Miller, Chairman, and Mrs. James Janis, Secretary, and one more telegram I would like to read:

"It is my understanding that the FWQA will be concluding an enforcement conference today concerning the pollution problems of Lake Michigan and that the major problem on the agenda will be that of thermal pollution from powerplants.

"Whereas the scientific evidence regarding this problem is admittedly inconclusive, it is my hope that it will be regarded as sufficient to permit agreement on a specific thermal standard for all plants on the lake. Any such standard will necessarily be an imperfect approximation of what is needed. Yet it would appear nonetheless to be an improvement over the current system in which different plants are held to different standards of beunt (sic.) depending on which State's shoreline is involved.

"As for what the new standard should be, as you well know, I lack the scientific competence to so much as hazard an intelligent guess. As a lawyer, however, I can advise that difficult questions of fact are often best resolved by reliance on the issue of burden of proof. With the question of thermal pollution, it would appear that the burden as to safety must lie on those who would introduce potentially dangerous elements into the environment. Unless that burden is sustained we may risk intolerable dangers to a resource we all hold dear.

"I wish you every success in your efforts. Sincerely yours, Philip A. Hart, Chairman, Subcommittee on Energy Natural Resources and the Environment."

I would like to place that telegram in the record. (Applause)

I guess, knowing Senator Hart -- I suspect I will be before the committee to explain whether it is successful or not successful in the future.

(The telegrams and statement referred to previously follow.)

Telegrams

(The following telegram was received from F. M. Baumgartner, President, CNRA.)

"The Citizens Natural Resources Association of Wisconsin strongly support Secretary Hickel's standard of one-degree increase in water temperature from atomic powerplants."

(The following telegram was received from E. K. Born, President, Sheboygan Chapter, Izaak Walton League of America.)

"The Sheboygan Chapter of the Izaak Walton League of America and the Sheboygan Chapter members serving as officers and directors of the state league heartily endorse that the water temperature increased by nuclear powerplant located on Lake Michigan be held to one degree. The state league is represented by 2000 members and the Sheboygan Chapter by 215 members."

(The following telegram was received from Mrs. Betty Priebe, Waukesha, Wisconsin.)

"Favor stand against water pollution. Am owner of bonds in Consumers Power. Environment most important."

(The following telegram was received from the Staff of Virginia's Beauty Salon, Eleanore Grace, Manager, Milwaukee, Wisconsin.)

"We urge your continued effort to set standards for Lake Michigan at the tolerable limit of one percent thermal addition above water temperature, according to Secretary of the Interior Walter Hickel's statement. We the general public may not be vocal but you have our full support. Happy New Year, dear Mr. Stein, to you and yours."

(The following telegram was received from Keith A. Ziolek, Park Ridge, Illinois.)

"Adopt strictest standard under consideration. Save the lake."

(The statement presented by the Elk River Drainage Basin Council follows in its entirety as if read.)

ELK RIVER DRAINAGE BASIN COUNCIL

TO PROTECT THE WATER AND LAND RESOURCES OF OVER
500 SQUARE MILES COMPRISING THE ELK RIVER WATERSHED

STATEMENT TO THE FEDERAL CONFERENCE
ON POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY
BASIN - THIRD SESSION. October 2, 1970,
Chicago, Illinois

Thank you for this opportunity to be heard relative to the preservation of Lake Michigan in general, and to thermal pollution in the Basin in particular.

The Elk River Drainage Basin Council operates in northern lower Michigan between Traverse City and Charlevoix and represents 30 municipalities and almost that many groups and organizations. Organized under Michigan Act 200 in December, 1969, the sole purpose of the Council is to work towards the preservation of the natural resources of the over 500 square miles within the Elk River Drainage Basin. The Basin outlet is at Elk Rapids, flowing into the East arm of Grand Traverse Bay.

This part of the country is still beautiful. But, even our clean waters now show increasing traces of algae, detergent foam, oil slick, muddy waters and the usual debris of litter which follow man's activities. Tourism provides the main economic base for the area - hunting, fishing, skiing, boating, etc. Agriculture is a mainstay with cherries being the special product.

Because of its natural attractiveness, many "downstaters" and out-of-staters are anxious to visit

A COUNCIL OF MUNICIPALITIES AND ORGANIZATIONS IN ANTRIM, CHARLEVOIX,
GRAND TRAVERSE, AND KALKASKA COUNTIES, ESTABLISHED UNDER MICHIGAN PUBLIC ACT 200.

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and live in this area. However, preventitive measures must be taken to protect those resources which are attracting the increasing numbers of part-time and full-time residents.

Because of this increasing population and the great potential for this increase, our Council is concerned about the future supply of power for homes and industries. Our power currently is supplied by several utilities - Consumers Power Company and Cherryland Rural Electric to name only two. New or enlarged power plants in the Basin could cause conflict in several ways, ranging from the aesthetics to the thermal discharge which has been an inherent part of any power installation to date.

Our waters are generally cold water streams and lakes which support an ecology of cold water fish and plants. Any type of mixing zones permitting heated effluent would alter the ecology of the involved area and permit the speed-up of deterioration of the waters because of the higher temperatures.

Our Council has not formally been involved in a detailed study of temperature standards, types of preferable cooling systems or construction techniques. It is felt, however, that the entire community would support strict enforcement of the highest standards for control and avoidance of thermal discharge. We would hope to have the opportunity to review and comment on any proposal for power plant construction within this Watershed.

We urge a Lake Michigan Basin adoption of the 1 degree maximum discharge temperature of heated effluent as recommended by the Federal Water Quality Administration. We are apprehensive of the ability to measure the temperature of mixing zones at all times of the year and so would encourage the measurement of the effluent at the point of discharge.

Strict enforcement of the strictest standards will be the only way

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in which cold water recreational uses can be preserved and true conservation attempts can be succdssful.

Thank you.

ELK RIVER DRAINAGE BASIN COUNCIL

Ted F. Miller, Chairman
Elk Rapids, Michigan 49629

June Janis, Secretary
Route 1
Williamsburg, Michigan 49690

Mrs. L. Erickson

MR. STEIN: Mrs. Erickson.

STATEMENT OF MRS. LOUISE ERICKSON, CHAIRMAN,
RACINE COMMITTEE FOR THE NATURAL ENVIRONMENT,
RACINE, WISCONSIN

MRS. ERICKSON: I am Mrs. Louise Erickson from Racine, Wisconsin. I am speaking for the Racine Committee for the Natural Environment.

By an analysis of the ecosystems of Lake Michigan, by studying the huge numbers of carp, alewives, smelt, and other fresh fish, it is apparent to most of us that Lake Michigan is already a lake which is ecologically very ill. Therefore, the Racine Committee for the Natural Environment maintains that thermal pollution of Lake Michigan should not be allowed, and toward this end supports the proposed standard of one degree temperature rise.

I should like to make some further comments. First, I am going to make some comments in regard to Green Bay. As you saw Green Bay on the map -- the geological maps which were shown earlier -- you could see that Green Bay is essentially a very shallow bay, particularly in its south end.

I have been in the area of Green Bay all my life

Mrs. L. Erickson

in summers. We have a cottage on Washington Island and I have been in this area every summer since I was 3 years old.

On the peninsula, there is a beautiful park called Peninsula Park, and there is a tower here, and I can remember as a girl that looking off that tower over Green Bay the water was blue as blue could be, and now when you look at the water, it is very brown. The fishermen who used to fish in Green Bay cannot fish there anymore. They can't catch fish in Sturgeon Bay. You can't catch fish off the west side of the peninsula. In order to get good eating fish most of the time they need to go off the end of the peninsula. Green Bay itself must be too polluted, too disturbed for proper fishing.

The algae have become thick in Ellison Bay. I swam there this summer. The rocks are just absolutely covered with green.

I heard a fisherman speak 3 or 4 years ago at a water quality hearing on Sturgeon Bay. He said they used to cast their nets out at Sturgeon Bay but they can't do it now and sometimes when they put their nets in the water, the fish would be caught alive and a tide would come over and the fish would die before morning in the nets.

Mrs. L. Erickson

The algae are beginning to come to Washington Island where our cottage is. I can remember some 20 years ago that one could see the bottom in 30 feet of water. Well, you can't do that anymore; it is getting cloudy. They are beginning to get many carp there on this island which is quite a ways out in the middle of the lake, in the bay.

Now, none of this, I presume, is directly attributable to the power companies nor their thermal load that they may place on the lake. But I should like to make a special plea that Green Bay is almost dead at its south end, that it receives a huge load of pollution from the Fox River every day.

A statement was made at a Green Bay conference on the lake that the amount of pollution going into Green Bay was equal in biological oxygen demand as if a city of a million people were putting its pollution into Green Bay every day with no treatment. So you can see that the south end of Green Bay is a great problem area.

So, therefore, I would like to make a plea that Green Bay be considered as a special instance of -- a special part of Lake Michigan, and that due to its high priority as a problem area that plants be not allowed to be sited on Green Bay and contribute to the thermal pollution of this particular area until all of the sources of pollution can be cleaned up.

In regard to siting, I would like to make another statement: I, too, bewail the fact that the Kewaunee plant and the Point Beach plant were allowed to be placed so close to each other. One of these is a double plant, and they all three are fairly large, and so this is, in effect, locating three plants within just a few miles of each other.

Now, the thermal effects of this can be rather disastrous. I think this was a very great mistake in siting of plant location.

Then, I want to make another plea in regard to siting of a nuclear plant or plants. There is actually no reason why these plants should be allowed to be sited immediately adjacent to recreational areas. I personally have long enjoyed the Point Beach Park. But when I go there now and have to see these ugly towers in the plant that is already there, I feel that there is a certain amount of visual pollution of the beautiful Point Beach Park.

The Point Beach Park is also near to the Point Beach Forest in Wisconsin and isn't a very good help for that area.

Mrs. L. Erickson

The Cook Plant over in Michigan is right in the middle of the beautiful Grand Marais area which is being attempted to be preserved as a natural area. The Indiana Dunes are also having trouble becuase they have a fossil fuel plant that is sort of a problem for that lakeshore.

Wouldn't it be possible to have our electric plants placed somewhere that is not adjacent immediately to some beautiful area that we have preserved for the people to use as a recreational site? (Applause)

I would like to say that it seems apparent to me in reading some of the testimony and in hearing some of the statements at this meeting -- I have not been here the whole time -- that it is not only the power companies in Illinois that have a monopoly on not caring so much about the environment but I would like to point out that our Wisconsin power companies do not seem to do this either.

Then, in closing, I would like to say that I am very much concerned about Lake Michigan as a whole, and I feel that we may be approaching the point of no return.

I can remember when scores of fishing boats could go out in the lake and could reap the fish from the lake, and now the catch of whitefish and trout in -- Lake Michigan trout, and so forth, is almost miniscule.

I think we may be reaching this point of no return.

We may be reaching the point that Dr. Bardach mentioned for the lakes in Switzerland, or for Lake Geneva in Switzerland, when he spoke of the increasing rate of eutrophication. We don't know but what Lake Michigan may be on the beginning of this steep climb toward complete eutrophication. So I think we should be very careful and want to preserve our lake immediately before it is too late. So let us say -- borrowing a phrase of Dr. Bardach -- let us not contribute to the "galloping eutrophication" of Lake Michigan. (Applause)

MR. STEIN: Thank you, Mrs. Erickson.

Any comments or questions?

If not, thank you very much.

Ron McCandlis. As I understood it, Mr. McCandlis, you said your statement will be 2 or 3 minutes.

STATEMENT OF RON McCANDLIS, PRESIDENT PRO-TEM, MICHIGAN STEELHEAD AND SALMON FISHERMENS ASSOCIATION, KALAMAZOO, MICHIGAN

MR. McCANDLIS: Ron McCandlis. I live at 5619 Clato Street, Kalamazoo, Michigan. I am President of the Michigan Steelhead and Salmon Fishermens Association.

R. McCandlis

I wanted to take a minute to enlighten you gentlemen here at this table a little bit about how directly temperature affects fishing in Lake Michigan, or the Great Lakes as a whole, or actually fish around the world, as we are learning.

I have here in my hands a typical type of thermometer we use. This is an example of an electronic thermometer which I utilize in my research sport fishing on the Great Lakes for over 35 tackle companies. I do this as an avocation.

This is a Vexilar-Zonar thermometer.* We can measure temperatures from surface to depths as great as 100 feet.

You may question how important this is. Well, I can give you a good example. When we can reach 54-degree temperature water, we can catch fish on nearly any lure readily.

I was about to point out this particular tie clasp the second gentleman is wearing. If a hook were attached to that tie clasp, it would catch salmon in Lake Michigan in 54-degree water. As you move away from 54-degree water, each degree becomes important for the coho salmon. With lake trout, we are talking about 50-degree, in contrast to salmon, and we have learned to find the exact

*Trade name

temperature and we look for a temperature within one degree when we are fishing.

Now, this has been verified time and time again. If you want documentation of some of this, I do have records of my 1,500 documented hours of fishing on Lake Michigan.

A good example is over the past 6 weeks we have had fishing in Lake Michigan as one has never seen before. Three weeks ago in 10 hours I boated with a single rod and reel over 700 pounds of salmon, 58 fish, because the water temperature of 54 degrees could be attained exactly with great ease with the lure.

Earlier it was alluded to in the question of Dr. Bardach what happens in the thermal bar, in mixing across the thermal bar. Fish, especially salmon and lake trout, stay shoreward of the thermal bar. They will not cross the thermal bar in the spring and in the fall. A number of times I have experienced finding the thermal bar with my electronic thermometers. Fishing back and forth across the thermal bar and, as I suggested, to the inside of the thermal bar, I get a fish maybe on every rod, maybe sometimes on just one or two rods. When one crosses to the outside of the thermal bar, no fish appear on the electronic finder, where you can actually identify the species beneath the boat. You can note there are no fish on the outside of the thermal bar; within the inside of the thermal bar there are fish.

Also it was asked of Dr. Bardach and some other people here, or there was a suggestion or possibly an inference, that fish can escape heated water. This is not always true. The best example that I can think of is in 1968, when the salmon were returning to their home streams and the urge of spawning due to reproductive hormones in the system of the fish was driving the fish instinctively home to its river. It could not find any water temperature less than 64 degrees. It was impossible during that time to catch fish, and this has been documented.

The other example I would make on the --

MR. STEIN: How much longer will it take you to complete your 2 minutes?

MR. McCANDLIS: I will complete it with that.

I merely wish to point out that the temperature is very specific; within one degree, we can catch fish. And if you question how many people utilize this, I would like to end my comments in pointing out that on Labor Day of 1967, there were 39,000 fishermen fishing between the ports of Ludington and Manistee on Lake Michigan.

Give it some thought. (Applause)

MR. STEIN: Thank you. Are there any comments or questions?

Mr. McCandlis, thank you very much.

Again, I would say, we are here to hear you out, but the question is that some of you have waited a long time. The shorter everyone is in his presentation the nicer people who are waiting are going to think he is.

Dana Schindler.

STATEMENT OF DANA SCHINDLER, MANISTEE COUNTY ANTI-POLLUTION ORGANIZATION, MANISTEE, MICHIGAN

MISS SCHINDLER: Gentlemen of the panel and representatives of the conference, I am representing the Manistee County Anti-Pollution Organization, Manistee, Michigan. This is a small organization, but we bring this chloride problem to your attention because of its urgency for all members of the Lake Michigan watershed area.

MR. STEIN: Miss Schindler, how long will your presentation take?

MISS SCHINDLER: It will take from 15 to 20 minutes, sir.

MR. STEIN: Miss Schindler, I am afraid we have a problem here if we are dealing with thermal problems as well as chlorine problems.

Now, you can speak on this, but I am afraid we are going to have to give priority to thermal problems. Now, if you can't summarize your statement, I am going to have to ask you to step down and we will have people on thermal problems come first.

MISS SCHINDLER: The letter of invitation did not --

MR. STEIN: I understand that. I am just talking about when you get on. Can you summarize this or do you want to wait until later?

MISS SCHINDLER: I will go on.

MR. STEIN: Can you summarize your statement?

MISS SCHINDLER: It is immoral for Michigan industries to pollute water that the people of Illinois, Wisconsin, Indiana, and Michigan are going to have to try to drink.

MR. STEIN: Miss Schindler, I take it you are not going to summarize.

MISS SCHINDLER: I will summarize.

MR. STEIN: Thank you.

MISS SCHINDLER: I hope that most of you have had the opportunity to review this presentation. Your future drinking water is at stake.

Our organization took water samples and had them analyzed. Through investigation, we found that our drinking water was being contaminated with chlorides. For example, the chloride testing of Lake Michigan, 20 feet northwest of the Packaging Corporation of America's pipeline in Lake Michigan registered 220 parts per million. Michigan's State-Federal standard is 50 p.p.m. This is compared to the Indiana and Illinois State-Federal standard of 10 p.p.m.

Within the text of our attached report given at a Natural Resources Commission meeting in June, titled, "The Unpolluted Truth About the Water Pollution Problem in Manistee," we outlined every problem we were able to find in our area concerning the ground and surface water contamination. Nothing stated therein has been refuted by the Michigan Natural Resources Commission or their subsidiary agencies.

In our attempt to stop the chloride pollution of the ground and surface waters of our area which includes Lake Michigan, we drafted a letter to Ralph Purdy of the Michigan Water Resources Commission on June 30, 1970, a copy of which is attached -- June 13, excuse me. (See Pp. 1994-1996)

In this letter, our engineering data outlined three feasible methods to discontinue chloride discharge completely within 30 days, the simplest and most economical being to return the brine back to the now inoperative wells, thus returning the salt to the Sylvania level from whence it came. This would eliminate ground and surface water contamination.

The MWRC will not issue the cease and desist request which was included in the above letter saying that conclusive evidence of injury does not exist. If conclusive evidence does not exist, one would wonder, then, the meaning and the purpose of the water standards. Why have them when if they are violated it is not evidence enough?

On July 30, the MWRC issued a letter to all salt- and brine-producing industries. We attach a copy of this letter and ask you to note especially the target date of December 1, 1971, for the "elimination of concentrated chloride discharge." (See Pp. 1999-2000) We have since spoken to the MWRC and have inquired as to what disposition will be made of the lower concentrations of chlorides entering Manistee Lake and River and Lake Michigan both legally and illegally. The MWRC advised that they will probably have to establish a program, but to our knowledge there is no program planned except to ask these industries to voluntarily discontinue concentrated chloride discharge by December 1, 1971.

May I repeat that our engineering data has shown that this can be economically accomplished in 30 days.

We were not satisfied with this target date and our next step was to draft a second letter to Ralph Purdy again giving engineering data on how the major chloride producer could alter his process in a minor way to greatly reduce chloride discharge. To date, Mr. Purdy has not seen fit to reply to this letter dated August 28, 1970.

Turning specifically to Lake Michigan, the Packaging Corporation of America is creating a reverse estuarine by dumping 1 million pounds of chlorides per day into Lake Michigan which they purchase from Standard Lime and Refractories. This figure was confirmed by Norman Billings, Assistant Executive Secretary of MWRC, in a letter of May 11, (P. 2017) the point being that Section (k) of the Corps of Engineers 1956 permit for this pipeline allows a maximum of 5,000 pounds of solids to be discharged daily. We are talking about a discharge of a million pounds.

Therefore, it is MACAPO's opinion that the terms of the permit are being grossly violated by this chloride addition. Incidentally, these chlorides are added to increase the specific gravity of Packaging's 10.5 million gallons of paper mill waste dumped daily into Lake Michigan. These chlorides are supposed to make the very dark brown effluent sink and, therefore, disappear. The industry does this with the blessing of the MWRC.

You might arrive at some indication of the strength of the effluent which PCA is attempted to sink by considering the fact that in June 1950, paper mill waste from this above-mentioned industry, in combination with weather conditions caused a fish kill in Manistee Lake believed to have been the largest fish kill in the history of Michigan.

The 1956 order of determination did require improved waste treatment facilities but nevertheless please note particularly that a September 1963 letter from Mr. Purdy speaks of the improved condition of Manistee Lake, explaining that portions of the Packaging Corporation effluent had been diverted to the Big Manistee River and to Lake Michigan, as these bodies of water, he states, "... have ... the capacity to dilute the salt and assimilate the oxygen-demanding effluent." (See P. 2022)

Since this letter of 1963, our Nation has become aware that our oceans and Great Lakes do not have this sempiternal capacity, that our earth and water and air are limited in what they can supply without care, and that we are drawing close to that limit.

We hope that our Water Resources Commission would act according to this knowledge, even if it would mean reversing previous orders. And yet when the Packaging Corporation of America completes their $6.5 million secondary waste treatment plant in December 1972, we have been informed by Donald Voigts, their Environmental Director, that the brown color of their mill effluents will remain and that the chlorides cannot be discontinued; that they are "necessary to sink the color." (Out of sight, out of mind!)

D. Schindler

We are not saying that Packaging Corporation is not doing something about their pollution. Six and a half million dollars means they are doing something. But we are wondering if the priorities are correct.

Just a minute more.

We are gravely concerned about the continued addition of chlorides to Lake Michigan as this is a freshwater lake, and adding a million pounds of chloride daily is bound to have ecological consequences unnatural to freshwater.

I asked Donald Voights what he thought a million pounds of chlorides entering Lake Michigan daily would do and what effect this would have, and he shook his head and said, "Nasty."

Ecological consequences are of utmost importance especially when ground water contamination of the Manistee area and no doubt dryness and various misuses in other areas will force the Lake Michigan watershed area to rely on Lake Michigan for drinking water.

Our concern is multiplied threefold as a result of MWRC's Regional Engineer, Robert Courchaine's statement to MACAPO's secretary, that the MWRC may consider exempting the Packaging Corporation from the concentrated chloride dumping termination date of December 1, 1971, "as it might work a hardship on them."

The temperature as it leaves the factory is 90 degrees. Charter boat fishermen have said it is 4 degrees higher than the surrounding waters.

MACAPO has no desire to shut down any industry. The industries are only doing what the MWRC has allowed them to do. The economically feasible, technological methods are available to stop this willful pollution, but it is our opinion that the MWRC has placed the people of Wisconsin, Indiana, Illinois, and Michigan, second to the special interests of industry.

MR. STEIN: Is that the conclusion?

MISS SCHINDLER: It would seem a most reluctant attitude --

One can only conclude that if this -- just a minute, please.

The scope of this deterioration is not by any means a local problem. Those of us who have taken part in this Four-State Lake Michigan Conference can readily see that this vast volume of high parts per million of chloride can saturate the total volume of Lake Michigan.

One can only conclude that if this continues and no cease and desist is rigidly enforced, the whole of Lake Michigan will approach and surpass the high chloride standards set by Illinois and Indiana.

In conclusion, it is a sad state of affairs when the attitude of our State agencies is that of the old cliche: Speech is Silver, but Silence is Golden.

But this is an era when something must be said; more importantly, something must be done.

I thank you for this opportunity to speak, and we hope with your help that all pollutants of Lake Michigan will cease and desist. (Applause)

MR. STEIN: Thank you, Miss Schindler.

Are there any comments or questions?

MR. FETTEROLF: Yes.

I do not feel that a total response to this is called for at a conference on thermal pollution. But very briefly, I would like to say that in response to the letters sent out by the Michigan Water Resources Commission in August of 1970 asking the salt companies to enter into a voluntary agreement to virtually eliminate their brine discharges by December 1971 have been responded to, and the companies are investigating various techniques and will submit their plans as soon as they are prepared.

Now, once the plans are submitted, then we feel that these voluntary programs will then be incorporated into an enforceable stipulation by the Commission. For various reasons it is impossible for them to go ahead immediately. The areas are simply not available for them to dispose of their brines, but, Miss Schindler, there is one area in which your organization could be of a great help to the industry in that area: the Packaging Corporation of America is proceeding with plans for secondary treatment and disposal of their wastes. They are having a very difficult time in having any of the townships agree that they want this treatment facility on that land.

If you could perhaps work with the local officials up there to aid Packaging Corporation to find a suitable site which could be properly zoned, this could certainly expedite the matter.

MISS SCHINDLER: The people don't want the Packaging Corporation slime because it creates a horrible odor and it kills the trees. It is brown, untreated effluent, and no township is willing to accept this.

And in response to our statement about finding ways to return chlorides, or eliminate the chloride pollution, I am wondering why Mr. Purdy will not respond to our letters and what is wrong with the five or six methods we have suggested for eliminating chlorides?

And it does seem that there is no more

technological method than simply returning the salt back into the wells from which it came -- the inoperative wells. This would eliminate ground and surface water contamination without any problem at all, and our own engineering data has shown that this can be accomplished in 30 days. We have received no word from the MWRC as to why this plan is no good; if it is no good.

MR. FETTEROLF: I would be pleased to take this up when we get back in Michigan, but in the interest of time -- if that is your attitude, I would be glad to go into a detailed explanation of this.

MR. STEIN: Are there any more questions or comments?

MR. CURRIE: Yes, Mr. Chairman.

I find this testimony profoundly disturbing, and what I find disturbing about it is the possibility that any such things as described in the testimony may be happening to Lake Michigan.

I think this conference once again should be urged to reconvene at an early date in order to consider such problems as chloride accumulations and chloride inputs to the lake. I recognize that this is primarily a thermal pollution workshop. I think we have to get back together very soon and consider all our other problems of Lake Michigan, and I would urge the conference to reconvene soon in order to determine whether or not there has been compliance with the deadlines set down by the conference itself in the past and, if not, to cause legal action to be instituted wherever necessary to assure that compliance takes place; and finally to reconsider the adequacy of the standards themselves.

Again, I would like to note the comparison that Miss Schindler drew between the Illinois standard of 10 p.p.m. of chlorides for as long in the future as 1980, a standard which I criticized yesterday as too lenient, and the Michigan standard of 50 p.p.m. (Applause)

MR. STEIN: Mr. Currie, I have always said the four States up here had some of the best water pollution control programs in the country. I spent a good part of the fifties and perhaps some of the early sixties down in the southwest dealing with oil well brines and salt pollution on a massive scale. I thought we had that licked. I thought we had the remedial facilities down there with reinjection.

We have cleaned up tremendous oil fields where we had brine problems, and I surely hope the States can do this here without any assist from us again because we hate to slip back.

(Miss Schindler's report follows in its entirety.)

THE CHLORIDE CONTAMINATION
of
Lake Michigan at
MANISTEE, MICHIGAN

Presented by

Miss Dana Schindler

representing
the

MANISTEE COUNTY ANTIPOLLUTION ORGANIZATION (MACAPO)
of
MANISTEE, MICHIGAN

PRESENTED TO THE

FOUR STATE
LAKE MICHIGAN ENFORCEMENT CONFERENCE

September 28 - October 2, 1970
at the

SHERMAN HOUSE

Chicago, Illinois

Representatives of the conference:

It is immoral for Michigan industries to pollute water that the people of Illinois, Wisconsin, Indiana and Michigan are going to have to try to drink.

I hope that you have all had the opportunity to review this presentation. Your future drinking water is at stake.

When MACAPO was founded April 29, 1970, we decided to tackle the worst pollution problem our area had; water pollution. We didn't know what to look for. As one of our members put it:

You can see it,
You can smell it,
It's NOT water;
It's something else!

So we took water samples and had them analyzed. A copy of the analysis is attached.

Through investigation, we found that our drinking water was being contaminated with chlorides. These chlorides come from salt producing industries of our town; namely Morton Salt, Morton Chemical, Hardy Salt and Standard Lime & Refractories.

Within the text of our report, "The Unpolluted Truth About the Water Pollution Problem in Manistee," we outlined every problem we were able to find in our area concerning the ground and surface water contamination. Nothing stated therein has been refuted by the Michigan Water Resources Commission or their subsidiary agencies. A copy of the report is attached.

In our attempt to stop this chloride pollution of our ground and surface waters, which includes Lake Michigan, we drafted a letter to Ralph Purdy on June 13, 1970, copy of which is attached. In this letter our engineering data outlined 3 feasible methods to discontinue chloride discharge completely within 30 days. The MWRC will not issue the cease and desist request, which was included in the above letter, saying that conclusive evidence of injury does not exist. Copies of their letters to us of June 18 and July 30 are attached.

In early June we also learned that the MWRC had just completed a 2-year study of the Manistee area to determine what was responsible for the chloride contamination and what feasible methods could correct this.

On July 24, 1970, after much pressure on the MWRC from our group, Ken Childs, Geologist for the MWRC presented his study in Lansing. His findings, opinions, and recommendations are as outlined in our news release dated July 25, which is attached.

His study confirmed everything our previous reports had already brought to public attention and then some. Also attached is MACAPO'S presentation to the MWRC on that date.

The MWRC then, on July 30, 1970 issued a letter to all salt and brine producing industries. We attach a copy of this letter and ask you to note especially the target date of December 1, 1971 for the "elimination of concentrated chloride discharge." We have since spoken to the MWRC and have inquired as to what disposition will be made of the lower concentrations of chlorides entering Manistee Lake and the Manistee River, both legally and illegally. The MWRC advise that they'll probably have to establish a program to take care of that. So to our knowledge, the MWRC has no program plan except to ask those industries to voluntarily discontinue concentrated chloride discharge by December 1, 1971. By figuring the daily chloride discharge to Manistee Lake and Lake Michigan, these industries now have the green light to pollute YOUR drinking water with over 1 (ONE) BILLION more pounds of chlorides before they legally must stop.

We were not satisfied with this target date and our next stop was to draft a second letter to Ralph Purdy, again giving engineering data on how the major chloride producer could alter his process in a minor way to greatly reduce chloride discharge. To date, Mr. Purdy hasn't seen fit to reply to the letter dated August 28, 1970, which we also attach for your perusal.

Also attached is a copy of our letter to Governor Milliken dated September 1, 1970.

We have been in contact with the Corps of Engineers, our United States attorney and the Federal Water Quality Administration, urgently requesting their intervention on behalf of the people of the United States.

We have been advised that a federal investigation of the Manistee area waters is scheduled by FWQA, although we have no specific date when this will take place. We have furnished evidence to the Corps of Engineers and requested an investigation of the waters surrounding Manistee so they may furnish our United States Attorney with proof of violations of the 1899 Rivers and Harbors Act. To date, we have received no confirmation if or when the Corps of Engineers will investigate. The United States Attorney will not act until the Corps of Engineers furnish the evidence.

The Packaging Corporsion of America is creating a reverse estuarine by dumping 1 (ONE) million pounds of chlorides per day into Lake Michigan which they purchase from Standard Lime & Refractories. This figure was confirmed in Norman Billings' letter of May 11, 1970, which is attached.

In 1956, the Corps of Engineers issued a permit to the Packaging Corporation for their present 24 inch pipeline to Lake Michigan. Section of the permit allows a MAXIMUM of 5,000 pounds of solids to be discharged daily through this pipe. Therefore, it is MACAPO's opinion that the terms of the permit are being grossly violated by this chloride addition. Incidentally, these chlorides are added to increase the specific gravity of Packaging's 10-1/2 million gallons of paper mill waste dumped daily into Lake Michigan, which is supposed to make it sink and "disappear." This industry does this with the blessings of the MWRC.

In Manistee Lake in June of 1950 the paper mill waste from this above-mentioned industry, in combination with weather conditions caused a fish kill believed to have been the largest in the history of Michigan! Please note that a September 1963 letter from Mr. Purdy speaks of the improved condition of Manistee Lake, explaining that portions of the Packaging Corporation effluent had been diverted to the Big Manistee River and to Lake Michigan which he states, "have the capacity to dilute the salt and assimilate the oxygen demanding effluent." Since 1963 our Nation has become aware that our oceans and Great Lakes do not have this sempiternal capacity. And yet when the Packaging Corporation completes its $6-1/2 million secondary waste treatment plant in December 1972, we have been informed by Donald Voights, their Technical Director, that the brown color of their effluent will remain and the CHLORIDE CANNOT BE DISCONTINUED; that they are necessary to ...SINK THE COLOR!

We are gravely concerned about the continued addition of chlorides to Lake Michigan as this is a freshwater lake, and adding 1,000,000 lbs. of chloride daily is bound to have ecological consequences unnatural to freshwater. Ecological consequences are of utmost importance, especially when ground-water contamination in the Manistee area and no doubt dryness and various misuses in other areas will force the Lake Michigan watershed area to rely on Lake Michigan for drinking water.

Our concern is multiplied as a result of MWRC Regional Engineer Robert Courchaine's statement to MACAPO's secretary - that the MWRC may consider exempting the Packaging Corporation from the concentrated chloride dumping termination date of December 1, 1971,"if it might work a hardship on them."

MACAPO has no desire to shut down any industry. The industries are only doing what the MWRC has allowed them to do. The economically feasible, technological methods are available to stop this willful pollution, but it is our opinion that the Michigan Water Resources Commission has placed the people of Wisconsin, Indiana, Illinois and Michigan second to the special interests of industry.

Please refer to the news clipping which is attached as one further example of the ever complacent attitude of the MWRC In regard to the pollution problems of Manistee. Even after an exhaustive 2-year study by their State geologist, pointing out the extreme adverse chloride and paper mill waste deterioration which plaques the surface and ground waters of our area, members of the MWRC now take to the public podium to reinsure the main chloride polluters that any small gesture in reducing the chloride parts per million, whether by adding a volume of water or other devious means to perpetuate this facade upon the public can now stand reassured that the courts will take no action in public or private suit for cease and desist of chloride contamination as specified by MACAPO and highly recommended by their state geologist as a first step in the restoration of the waters of our area.

We of MACAPO feel that this is just another gesture by the MWRC to gloss over the major problem of our area, by usurping the final verdict of the courts of our land in favor of the continuation of this most immediate deteriorating pollution problem of our area.

The scope of this deterioration is not by any means a local problem,as any of the States bordering Lake Michigan who have taken part in the Four State Lake Michigan conference and are concerned over the chloride parts per million can readily see that this vast volume of high parts per million chloride can saturate the total volume of Lake Michigan.

One can only conclude that if this continues and no cease and desist is rigidly enforced, the whole of Lake Michigan will approach and surpass the high chloride standards set by Illinois and Indiana.

It would seem a most reluctant attitude on the part of the MWRC to ignore the major problem by inserting other pollution problems of the area, rather than attacking those which have been exhaustively researched for final and conclusive analysis as to their ultimate solutions and corrections; such as the chloride problem rather than the sewage problem which is a universal problem throughout the United States and the world, and it is a handy pawn to cast into the foray of pollution problems so as to create a diversion while the major stigma of our area runs rampant, unabated by any such firm cease and desist of chloride pollution.

It is a sad state of affairs when the attitude of our State agencies are that of the old chliche..."Speech is silver, but silence is golden." But this is an era when something MUST be said and something MUST be done.

We thank you for this opportunity to speak and not be silent. We hope that something will be done in the immediate future.

[illegible]

F. D. WORKS, [illegible]

WILLIAMS & WORKS

ENGINEERS — SURVEYORS — PLANNERS

250 MICHIGAN STREET, N.E.
GRAND RAPIDS, MICHIGAN 49503
TELEPHONE 459-4201

1984

May 22 1970
E-75650

Mrs. Carol Magnus
103 Sibben
Manistee, Michigan 49660

Dear Mrs. Magnus:

Subject: Lab analysis for Manistee County Anti Pollution Organization

Enclosed please find our lab report covering the water samples you brought to our office concerning subject project. Also included are two sheets of "Water Standards" published by the U. S. Public Health Service and State Water Pollution Control Board, Sacramento, California.

The cost for this analysis will be between $70 and $90 for which a billing will be issued shortly.

Sincerely yours,

WILLIAMS & WORKS

F. Winchester

lml

Enclosures

DIRECTORS T. C. WILLIAMS, E. S. THOMPSON, G. H. STADT, K. W. ANDERSON, M. M. CHAMBERS, F. E. SPICER,
R. L. ELLIOTT, J. A. MERDZINSKI, Z. R. MILLER, L. VANDER HORST, A. O. HUSTVEDT

LABORATORY DEPARTMENT

Water - Waste Water - Soils

Client: Manistee County	Project No. E-75650
Anti Pollution Organization	Date: 22 May 1970
Mrs Carol Magnus, Sec.	Chemist: DN & DB

SAMPLE

	#1	#2	#3	#4	5	
CHLORIDE	220 mg/l	170 mg/l	380 mg/l	380 mg/l	50 mg/l	
C.O.D - supernate			35 mg/l	22 mg/l	0 mg/l	
C.O.D - mixed sample	57 mg/l	22 mg/l	3362 mg/l	84 mg/l	1344 mg/l	
MAGNESIUM			36 mg/l	214 mg/l		
pH	7.5	7.1	7.2	7.4	7.3	
PHENOL					0.0 mg/l	
PHOSPHORUS - supernate					0.15 mg/l	
PHOSPHORUS - mixed sample					10.2 mg/l	
Sodium	48 mg/l	35 mg/l	95 mg/l	168 mg/l	25 mg/l	
SULFATE					25 mg/l	
SULFIDE - Supernate					0.0 mg/l	
SULFIDE - mixed sample					5.2 mg/l	

#1 - LAKE MICHIGAN, 20' NW PIPELINE

#2 - MANISTEE RIVER, BELOW COMBINED PIPE, 25'

#3 - MANISTEE LAKE, 1st POINT NORTH of STANDARD LIME off EAST SHORE, in 35' at bottom.

#4 - MANISTEE LAKE, HARDY'S, in 45' at bottom.

#5 - MANISTEE LAKE, NORTH end PCA, 20' at bottom.

MIXED Samples included sludge at the bottom of samples #3 (½"), #4 (¼") and #5(
( ) Depth in gallon jar.

1986

THE UNPOLLUTED TRUTH
ABOUT THE
WATER POLLUTION PROBLEM
IN
MANISTEE

Report of the

MANISTEE COUNTY ANTI POLLUTION ORGANIZATION (MACAPO)

presented by
Rick Magnus

at the

NATURAL RESOURCE COMMISSION
MEETING

June 11, 1970

Bay City, Michigan

1987

MANISTEE LAKE

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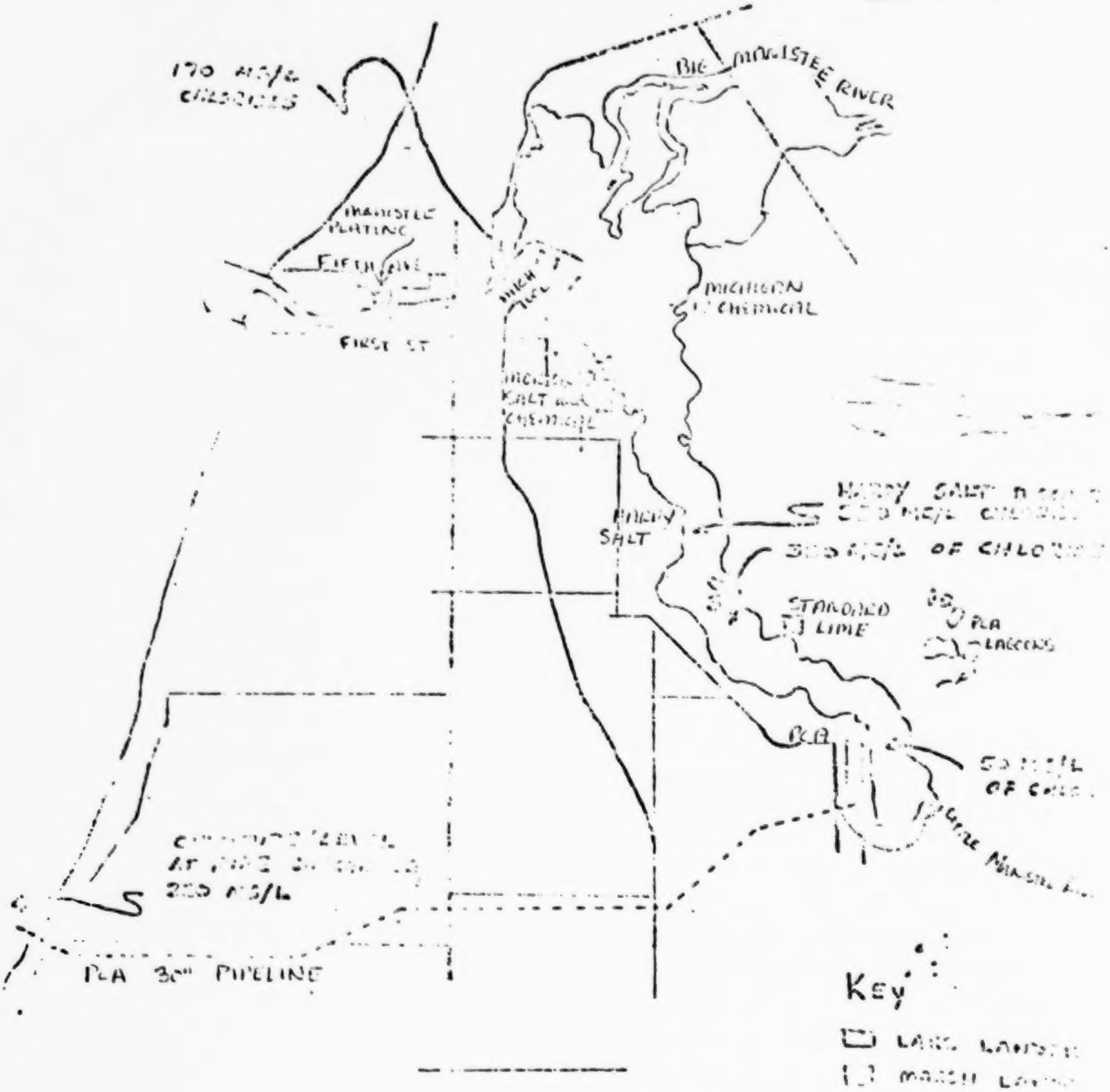

Our Organization, MACAPO, has been in existence less than two [illegible]. The following report is the result of many hours of research, testing, questioning and letter writing. Some of this data was obtained only through the efforts of our State Representative, Dennis Cawthorne.

MACAPO has spent a good deal of money having water samples analyzed. The chloride levels indicated in this report are part of these results. Please keep in mind that these test samples were taken on a Saturday and Sunday and not during the normal full production week.

We will start our presentation at Lake Michigan and work our way up the Manistee channel and into Manistee Lake.

In 1957, the Packaging Corporation of America, Filer City plant, was issued an Order of Determination by the Michigan Water Resources Comm. to construct and maintain a 30 inch pipeline from their Filer City plant to an outfall in Lake Michigan. The discharge per day is 10,580,000 gallons, to consist of "evaporator condensate from chemical recovery of kraft and neutral black sulfite liquors, pulping and bleaching waste and machine white water from kraft neutral sulfite semi-chemical and cold_caustic operations."

During December 1963, the Water Resources Comm. demonstrated that PCA was not conforming to the original restrictions and concluded that the undesirable odors and colors in Lake Michigan, as a result of the PCA discharge, were detrimental to uses being made of the lake. PCA was requested to take corrective action. The company proposed to increase the specific gravity of its waste through the addition of brines which were being discharged to Manistee Lake by a neighboring company. On August 15, 1964, the Lake Michigan PCA discharge was increased by the addition of approximately 1,000,000 lbs. of chlorides per day which PCA purchased from Standard Lime & Refractories. This is just sinking a tremendous problem, not solving it. The bio-chemical oxygen demand of this discharge is about 40,000 lbs. per day per Norman Billings' letter to us of May 11, 1970.

This 30 inch pipeline is supposed to be checked annually. However, according to MWRC staff engineer, George Liddle, this outfall has not been checked for 2-2½ years. Mr. Liddle stated at our meeting May 23, 1970 that he is satisfied in his knowledge of what the outfall contains and sees no reason to sample this now because a PCA secondary waste treatment plant is to be in operation December 1, 1972.

The residents on Red Apple Road, whose homes overlook the lake in the vicinity of the outfall still complain of odor and water discoloration. The charter boat fishermen advise that under certain conditions, this discoloration extends from the outfall as far north as Frankfort, Michigan. The charter boat fishermen also advise that they have seen and retrieved paper refuse from this area of the outfall on many occasions. They have also taken water temperatures at this outfall and advise that there is about a 4 degree higher temperature at the outfall than in the adjacent water areas.

It is our contention that the recreational use of this area of Lake Michigan has been severely impaired by this outfall. A chloride level of 220 mg/l was tested at this location.

At our meeting May 28, George Liddle was asked if he was aware of the fact that a number of private residences and the U. S. Coast Guard station on the end of Fifth Avenue were pumping raw sewage directly into the Manistee River. He said that he was aware of this fact.

There is a firm, the Manistee Plating Company, which is located on the Manistee River. According to the Michigan Department of Health Air Pollution Survey of 1964, this company uses the following chemicals:

Chromic Acid
Copper Cyanide
Hydrochloric Acid
Sulfuric Acid
Nickel Sulfate.

George Liddle was asked at our meeting May 28, "What do they do with their waste chemicals?" Mr. Liddle then asked us, "Do you know if they go to the lake or to the sanitary system?" He then said "Perhaps we ought to look into this." This plating company, being located on the north side of the channel is in an area of town where most, if not all, of the sewage is dumped raw into the channel. It makes little difference what the plating company does with their effluent, it still could get to the channel. This company could be 100% clean, our worry is that they haven"t been checked.

In the Manistee River there are a group of eductor pipes located near the Memorial Bridge. This is the discharge point for 387,000 pounds of chlorides per day. Two of the industries using these pipes are Standard Lime & Refractories and Morton International. Our tests show 170 mg/l of chlorides in this area. Morton is the chief user with Standard Lime using these discharge pipes in the event that PCA is not able to use the 1,000,000 pounds per day for some reason ([illegible] Lake cells being [illegible] PCA to sink its pollutants in Lake Michigan.)

Michigan Tool Corporation, a division of Manistee Iron Works is located on Manistee Lake, at the mouth of the Manistee River. This company is somewhat of an unknown quantity with our group. They are beginning to landfill part of the lake and we suspect that some sort of discharge, perhaps oil, is connected with this operation but as yet we cannot say for certain.

Michigan Chemical is located on the east shore of Manistee Lake. The state has issued an Order of Determination for their discharge into Manistee Lake. The chemical they produce is bromine. The state contends that their discharge is "insignificant." However, the state also admits that they do not physically sample these pipes annually. We have had reports that this discharge pipes does emit brine, sometimes in large quantities, but we have not as yet made a positive check.

Hardy Salt is located on the west shore of Manistee Lake and we believe this company to be a chief offender as to chloride levels. The State of Michigan has no Order of Determination for their discharge. Our own water tests analyzed by a private laboratory show this area to contain 380 mg/l of chloride.

Morton International (salt & chemical) has an Order of Determination which reads as follows: "...to the Manistee River...up to 387,500 pounds per day of chloride...into Manistee Lake 65,500 pounds per day of chloride...also into Manistee Lake, 250,000 pounds per day of chloride ion." At point #5 on our map, the tests found 380 mg/l of chloride. Semi-solid "mag" waste has filled the lake to depths of over 12 feet. We took depth soundings across the mouth of the "finger" of Manistee Lake where the fill is occurring. On the south side, the water is 18 feet deep, then abruptly rises to 4 feet and then drops to 20 feet on the north side.

We now realize that we should have also tested the Morton area as well as the Michigan Chemical area, but as we were novices, we were not exactly sure just what to look for at the time.

Packaging Corporation of America is located on the west shore at the south end of Manistee Lake. This company has waste discharge pipes opening directly into Manistee Lake, plus waste ponds shown on the map in addition to its 30 inch pipeline into Lake Michigan. While the chloride level should be less in this area, our tests show 50 mg/l as indicated on our map. Their discharge pipes into Manistee Lake contain enough solid materials so as to have formed a landfill via hydraulic action. This fill extends at least 25 yards into the lake from the eastern edge of the vegetation.

that when we attempted to take depth soundings at this 25 yard point, our boat ran aground. In addition, the bank area of PCA has been landfilled with factory residue, bark, rubbish, etc., all leaching into Manistee Lake.

Please note that around 1952, the State of Michigan gave PCA approximately 15 per cent of the flow of the Little Manistee River for their production of paper. They use at least 1,000,000 gallons a day of this industrially unpolluted water, and return it as polluted brine to Lake Michigan.

If the State of Michigan sets a fee for oil and gas rights, which are a natural resource, then HOW can they GIVE away a precious resource like nearly pure water? If the State of Michigan had charged PCA only half the rate the water department charges the people of Manistee for drinking water, the DNR treasury would have increased over 1 (ONE) million dollars in just the last 12 years. This money could have employed [illegible] ([illegible]) full time research biologists for the last 12 years

Packaging Corporation of America is also landfilling a marsh, the surface of which seems to be a foot or so above the "ordinary high water mark". The fill material is various wastes from their paper plant. It seems to consist mostly of wood fiber and bark with smaller amounts of inorganic waste. The fill presently extends to the edge of a small stream. This fill is being dumped directly into water. There are streams running through this marsh. We contend that the fill has displaced the wet marsh and is now actually in the water. The bottom layers of the fill are below the "ordinary high water mark." To our knowledge, the State has not yet begun the survey and investigation into this landfill as our organization requested in our letter to [illegible] of May 7, 1970.

A spider web of pipelines criss-cross the Manistee Lake bottom and these lines carry waste liquors from PCA and brine from industry to industry. There is reason to believe that these lines develop leaks and that a rigid inspection schedule has not always been followed.

In January of 1970, a water well servicing the Standard Lime plant was ruined. The water was a black color and unfit for drinking. [illegible] hill to the east of their plant are the open ponds which PCA uses to dump the black liquor. The well went bad just after the bottom of these ponds was disturbed by a dragline to increase drainage into the soil. We are not positive this was the cause, but the timing tends toward this conclusion.

Standard Lime & Refractories is located on the east shore of Manistee Lake in the southern third of the lake. This company has disposed of its waste brines by piping them to both PCA from whence it is discharged to Lake Michigan and to Morton International from whence it eventually enters Manistee Lake or the Manistee River. We have tested other pipes coming from Standard Lime with one test showing 14,3[illegible]0 ppm of hexane extractables (oil). Standard Lime has also landfilled part of the lake.

George Liddle indicated at our meeting on May 28 that he has been aware of both the Morton International "mag" landfill and the PCA landfill which were previously described, but that he did not contact the Submerged Lands division in Lansing to alert them of these willful violations of state law.

George Liddle was also asked how many pipes he know of discharge industrial waste into Manistee Lake. His reply, was "about 22." Members of our organization have spent time out on Manistee Lake for the sole purpose of counting pipes and obtaining samples direct from these pipes. MACAO'S pipe count is 58 to date, with 4 pipes recently discovered in the Manistee River. These are only the pipes that are above water. Two of those pipes are leaking oil into Manistee Lake. We advised Mr. Liddle that we are willing to furnish a boat and personally take him to these two oil pipes, of which he is not aware. When we asked Mr. Liddle if he was going to shut down the 38 illegal pipes that he didn't know about he replied, "No, I can't shut them down until I know what is coming out of them." This is in spite of the fact that the companies have constructed illegal discharge pipes, and that they have no Order of Determination to cover their discharge.

As you can see from the above, we do have a serious problem. Our lake has been landfilled by industrial rubbish, polluted by everything from raw city sewage to high potency chemicals and chlorides. One of the WRC biologists, Michael Newton admitted that much of the lake bottom is dead and the rest of it is below average. Thick sludge and settlings from these industrial processes have coated the bottom of the lake. For example, off the Hardy discharge, the depth sounder goes from 42 feet to 18 feet to 38 feet, indicating a substantial bottom buildup. We do not willingly eat the panfish in Manistee Lake because of their bad taste.

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As a group, we are shocked and disgusted by the roadblocks thrown in our path by State officials. We are disgusted by laws that are apparently written by and for industry. We are disgusted by evasive answers and by departments which make up their own rules which are not specifically written into the laws and by State officials who tell us that reports and answers we ask about are "none of your business." We resent the inference that we are not intelligent enough to read and evaluate state reports.

Since this paper was written, we have found some of the extent of our chloride problem in Manistee. The city has had two water wells test out too salty to use. We have found that there is an extensive chloride report that is not yet completed. Once chlorides seep into our drinking water, we will be in trouble. We have found that our industries could pump their chlorides back down into the brine wells where they came from. They could stop this chloride pollution within a very short time. The time is now to force them to do this. This will cause them some expense and they won't get the revenue from this waste brine as they do now. But we must stop this chloride pollution of our drinking water, one of our most necessary resources.

CONCLUSION

We contend that the People of the State of Michigan and our diminishing natural resources have been placed second to the special interests of industry. We hereby request a complete investigation of the Michigan Water Resouces Commission, as the M.U.C.C. will propose, at the earliest possible moment.

The time is now to put priorities in proper perspective. We MUST put an end to this practice of State permissiveness toward industry.

We have laws. Since you fully enforce them where the private citizen is concerned, then we DEMAND you equally enforce them with industry.

MANISTEE COUNTY ANTI POLLUTION ORGANIZATION
(MACAPO)

Box 282
Manistee, Michigan 49660
June 13, 1970

COPY

Mr. Ralph W. Purdy, Executive Secretary
Water Resources Commission
Stevens T. Mason Building
Lansing, Michigan 48926

Dear Mr. Purdy:

We, the members of MACAPO, request that the Water Resources Commission, give most urgent consideration to a Cease and Desist Order of Determination for chloride disposal by all industries in Manistee County.

The time period for the Cease and Desist order should be liberal, thus bearing no hardship on any industry and we suggest the consideration of a 30 day time period, effective July 30 of this year, which is more than ample to comply with the above order, in our opinion.

The Cease and Desist order should be explicit in the elimination of chlorides being disposed in the following areas:

1. Lake Michigan
2. Manistee Lake
3. Big Manistee River
4. Little Manistee River
5. Any land area of Manistee County where seepage or process of osmosis will allow chlorides to contaminate adjoining waters and/or properties above the Sylvania level.

To say that the above Cease and Desist order is not practical or feasible because of the recommended 30 day compliance period, is to belittle the ingenuity of free enterprise and that old Yankee know how in getting a job done.

Since the industries of Manistee are working together in disposing of chlorides into the surrounding waters of this county and Lake Michigan, it seems only equitable that they should work jointly in the compliance with the Cease and Desist order and accomplish said same in the above period of 30 days.

If there is a lack of [illegible] on those in industry, let us try the [illegible] approach to the problem as the simplest solution might very well be the cheapest and most practical.

Therefore, the following plans are submitted for solutions to accomplishing the Cease and Desist order within the time period allowed.

1. Morton Salt and Chemical, Standard Lime and Refractories, and Hardy Salt are the major chloride disposers to the above mentioned waters, and therefore, should work jointly in the solution of this problem.

A. Morton Salt & Chemical, have in their possession, abandoned salt wells below the Sylvania level capable of receiving waste chloride and chemical solutions.

B. Standard Lime has in their possession chemical brine wells that are pumping on a marginal basis. These marginal wells could be the recipient of tail brines which would enhance the static level of the field within the near vicinity in the Sylvania level.

C. Hardy Salt has a variety of wells, some of which are not conducive to the production of quality products and could be used for receiving excess chlorides and/or chemicals.

Therefore, each of the above industries has, within its own industrial complex, some facility by which the addition of a pump and length of pipe can return the excess chlorides and waste chlorides to the strata from whence they came and meet the 30 day compliance period. Thus the cost annually would be the pumping of these products and by-products to the strata and the loss of a slight amount of money from the profit column of their annual statements since these chlorides will not be sold for the purpose of hiding other industries contaminants.

2. Providing imagination is lacking for the above program by which each industry would have to provide his own pipe and pump, the following method is suggested.

   A. The jointly owned 14" pipeline which presently festoons our lakeshore from the Manistee channel eductors to the effluent tank at Standard Lime and Refractories, could be used as a cooperative pipeline for the above three mentioned industries. Standard Lime, being in the closest proximity of a well conducive to good disposal potential could be the recipient of the excess and waste chlorides of Hardy and Morton International; thus reducing the pumping costs to that of a single well rather than an individual well by each of the three. Since it is a proven fact that chloride solutions can be pumped in either direction through the present 14" line as experienced by Morton and Standard, each being at one end of the line, it is simple to conclude that Standard could be the sole disposer. Hardy Salt, being located in a close proximity to the 14" pipe could very well tie into it for the purpose of participating in a single disposal system. Standard lime would undoubtedly use their S-1 brine well for their primary disposal well, with S-4, S-5, S-6 or S-2, which are all close to S-1, as a standby well for alternate disposal purposes; thus allowing the use of one of the above mentioned wells as an alternate while preventative maintenance is being performed on S-1 to maintain its good receptive properties. Thus by selecting S-1 and one of the above mentioned marginal producing wells as a disposal system, the area would be ensured of continuous and complete disposal of all excess and waste chlorides in this area.

3. If the above two mentioned methods are of such magnitude as to make the loss of profits deem these methods impractical, the following method will ensure each of the above or the three jointly of a profit from the sale of these chlorides.

A. The production of calcium chloride is within the financial justification of the above three mentioned industries, due to the high quality of chloride brines which are now wasted as a contaminant of various waters. It is common knowledge that Standard Lime & Refractories has considered the construction of such a calcium chloride facility on a profit making basis.

Therefore, we can only conclude that industry can and will comply with a Cease and Desist order, if issued, as each has within its own industrial complex, or jointly, a system for disposing of these chlorides on a no profit or profit basis, as the three can jointly choose.

Because of the multitude of contaminants entering the waters of our area, we select but one for the Cease and Desist order as a first step in the elimination of the many contaminants that must be stopped from entering our waters. Although this is only one, our members feel it is the easiest to eliminate, through and by the above mentioned methods. A copy of your Cease and Desist order in regard to all chloride Orders of Determination issued to these three companies will be greatly appreciated.

Our Senators and Representatives are most anxious to see the total elimination of these contaminants and we feel that this small step will be a big move in the right direction for the eventual cessation of all pollutants to these waters.

Respectfully submitted,

(Mrs.) Carole Magnus, Secretary representing the
MANISTEE COUNTY ANTI POLLUTION ORGANIZATION
(M.C.A.P.O)

cc: Governor Milliken
Sen. Robert Griffin
Sen. Philip Hart
Rep. Guy Vanderjagt
Rep. Dennis Cawthorne
Sen. Oscar Bouwsma
Sen. Jack Toepp
Ralph MacMullan
Dale Granger

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
AUGUST SCHOLLE
Chairman
CARL T. JOHNSON
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WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
RALPH A. MAC MULLAN, Director

WATER RESOURCES COMMISSION
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GEORGE F. LIDDLE
JOHN H. KITCHEL, M.D.

June 18, 1970

Mrs. Carole Magnus, Secretary
Manistee County Anti-Pollution Organization
Box 282
Manistee, Michigan 49660

Dear Mrs. Magnus:

This will acknowledge and thank you for your letter of June 13 relative to the problem of water pollution in Manistee Lake, the Big and Little Manistee Rivers and Lake Michigan.

The aggressive interest of your group in the enhancement of the quality of these waters is sincerely appreciated and will unquestionably be of considerable help to the Water Resources Commission in its program to place and keep them in the condition they must have.

Your letter will be presented to the Commission at its June 25-26 meeting. I would point out that the law vests its specified pollution control authority in the Commission--not the Commission staff. I shall, however, report that the matter is the subject of ongoing, intensive investigation by the staff with intended very early submittal of its findings to the Commission.

Your group's support will be especially needed by the Commission in the establishment of unlawful pollution. I believe you are acquainted with the law's definition of unlawful pollution (see Sec. 6(a), attached) and I would emphasize the fundamental need to show that a given waste disposal is or may become injurious to any of the values cited therein. You will appreciate that the Commission cannot rest its case upon presumption that a discharge must be pollutional. Neither statutory law, constitutional law nor common law will recognize a presumption that is not based upon fact, and neither your group nor the Commission would gain anything from an action that is not legally founded.

I accordingly encourage you very strongly to look beyond identification of the various discharges, important though that is, and be preparing yourselves to provide the Commission with testimony on how the discharges are causing or may cause injury. We of staff will be reporting to the Commission on the nature and volume of the discharges and will look to the Department fisheries authorities to evaluate their effects upon fish life. Such information, however, cannot substitute for testimony by the people who are affected.

In my capacity as a Deputy Director of the Department of Natural Resources, I am also concerned about the question of the possibility of fills which may be illegal under Act 291, of P.A. 1965, as amended. Mr. George Taack has discussed with me your recent letter concerning fills, and we have underway a full survey of the Manistee Lake area to determine what action may be warranted. The survey will be completed within 30 days.

Again, we appreciate your support and shall look forward to its meaningful continuation.

Very truly yours,

WATER RESOURCES COMMISSION

Ralph W Purdy

Ralph W. Purdy
Executive Secretary

NB:bs
Encl.

STATE OF MICHIGAN

WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
RALPH A. MAC MULLAN, Director

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GEORGE F. LIDDLE
JOHN H. KITCHEL, M.D.

July 30, 1970

Mrs. Carole Magnus
Box 282
Manistee, Michigan 49660

Dear Mrs. Magnus:

Thank you for your kind letters of July 27. It was good to meet you also.

I do not sense that the Commission members intend to await final publication of Mr. Childs' report before initiating formal action against the waste disposers, but, indeed, that their purpose in hearing the summary presentation was so that they could get on with the job. I further sensed the members' conclusion, as summarized by Mr. Vogt, that such matters as the housekeeping, which appears to underlie a good bit of the problem, were to be pursued promptly and staff will proceed with consultations along that line with officials of the companies involved, looking to such voluntary improvements as can be effectuated, even while the formal instruments are being developed.

As stated at the meeting, Mr. Childs' report is in draft stage, and it will take some time, probably a few weeks, before it finally clears the Central Duplicating office of the State and can be mailed out. You will have a copy just as soon as it is ready.

May I attempt in this letter to respond also to the questions you asked in your July 24 statement. I shall have trouble in doing so to your satisfaction, I'm afraid, because they involve, in part, matters of common law and constitutional law in which neither I nor any of our staff are really authoritative.

1. The Orders which this Commission is authorized by law to issue must be aimed at the prevention of unlawful pollution, which as you understand, are set forth in Section 6 of Act 245 (P.A. 1929). While I believe that injury to the ground waters (or, technically, public health and welfare) seems well established, the total prohibition of chloride discharge to surface waters would be extremely difficult and probably impossible to defend as being necessary to prevent injury. A "Cease and Desist" order does not appear to be prospective, but Final Orders of Determination, or Stipulations leading to Final Orders if necessary, certainly are prospective. I cannot now estimate the detailed requirements of those instruments and can only say that they will be whatever the Commission deems necessary to prevent unlawful pollution.

2. To insure against unlawful discharges, the Commission will undoubtedly require submission by the industries of detailed sampling reports. Commission

MICHIGAN
THE GREAT LAKE STATE

staff will keep the affected industries under surveillance, both by sampling and by inspection of operations.

3. The Commission has, in the past, pursued penalty proceedings only in case of flagrant or continuing violation. Should such situations develop at Manistee or anywhere else, we expect that it will take aggressive action.

4. Requirements for pressure testing of pipelines may well be contained in the Order or Stipulation. Staff have not developed their detailed recommendations for testing and reporting.

5. Michigan's chloride standards for intra-state waters are 75 ppm at domestic water supply intakes. Numerical limits have not been set for the protection of other values, but are stated in general terms. For the Great Lakes, 50 ppm is the maximum for domestic water supply, computed as a monthly average, and 10 ppm is set as the desirable level where existing conditions are less than 10. One hundred twenty five ppm is the monthly maximum for industrial use protection. Our chloride standards for Great Lakes waters have been approved by the Secretary of the Interior. I am sorry that I do not know what the Great Lakes chloride standards are for the other Lake Michigan states, but in any case, I should be unable to say why they differ from Michigan's if they do.

While we are glad to respond to specific questions as best we can, we are most especially interested in conveying the sense of the Commission's position and program on water pollution control. Perhaps your observation of the Commission's proceedings has given your group some reassurance in that respect. In our earlier correspondence we have emphasized the element of injury prevention as the Commission's statutory designated duty and objective. The Commission cannot be arbitrary nor act peremptorily. If proceedings seem unduly protracted, I must state that the Commission acts on matters as rapidly as staff can place them before it. You saw at the July meeting virtually all of our administrative staff, and only a few of them can be assigned to the exacting task of translating the assembled information into specific action requirements.

I believe that you can expect expeditious pursual of a corrective program on the Manistee area problems. We shall look forward to your continuing support.

Very truly yours,

WATER RESOURCES COMMISSION

Norman Billings

Norman Billings
Acting Executive Secretary

NB:bs

([illegible])

FOR NEWS RELEASE JULY 25, 1970

At the Water Resources Commission meeting in Lansing, July 24, Ken Childs Geologist for the WRC, presented his surface and ground water study of the Manistee area. This study took in some 50 square miles in and around Manistee.

Mr. Childs made a brief summary of the history of the salt, brine and paper industries. His study brought to light industrial practices resulting in the degradation of surface and ground waters.

Mr. Childs study revealed that the Packaging Corporation of America pump part of their paper mill waste through a 30 inch pipeline into Lake Michigan. This discharge contains approximately 8-10 million gallons a day of paper mill waste, plus another 1-1½ million pounds of chlorides, which are used to sink the effluent.

The Packaging Corporation also pump waste to ponds in Section 17 in Stronach, consisting of between 15-60 million gallons per month or a total of a minimum amount of 3½ Billion gallons of untreated waste, which infiltrates into the ground water, causing water degradation. M

Mr. Childs study revealed that the salt companies, Morton & Hardy pump the majority of their industrial waste brines into Manistee Lake and that they also have an industrial practice of back flushing their salt wells. Both of these contribute to the degradation of the ground and surface waters.

The brine industries, Standard Lime and Morton Chemical, discharge industrial waste either to Manistee Lake or the Manistee channel eductors, further contributing to ground and surface water degradation. Mr. Childs stated that all of the brine and salt industries "are guilty of many general practices of housekeeping in referance to operations at well sites and plant sites resulting in ground water degradation."

Two other types of degradation of ground water of minor significance were reported by Mr. Childs: 1. Poor septic tank isolation and 2. Ice and dust control which cause an increase in chloride levels in the shallow wells close to the main arteries.

Mr. Childs concluded: "This area shows evidence of ground and surface water degradation from industrial operating practices past and present." "In the order of their importance:

1. Chloride using industries
2. Paper mill industry
3. Ice and dust control
4. Septic tanks

"It is believed that if these recommendations are useable, you could virtually eliminate all present wastage of chlorides to surface and ground waters of Manistee."

1. Return production wastes to brine formations and salt galleries.
2. Terminate back flushing practices of salt companies.
3. Review and improve upon general practices that are presently resulting in wastage around plant and well sites.
4. Terminate the use of the paper industry lagoons in Section 17 in Stronach because additional waste, assuming the premise that they are providing recharge to the lake, will only provide more waste that will eventually reach the lake.

STATE OF MICHIGAN

[illegible] COMMISSION
[illegible]

WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
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JOHN P. WOODFORD
JIM GILMORE
GEORGE F. LIDDLE
JOHN H. KITCHEL, M.D.

August 28, 1970

Mr. A. L. Winfield
Vice President
Hardy Salt Company
Manistee Salt Works
1501 Main Street
Manistee, Michigan 49660

Dear Mr. Winfield:

Recent surveys by staff of the Water Resources Commission have shown that the degradation of ground and surface waters in the Manistee area has and is occurring because of some of the operating practices of the local chloride using industries. Staff presented a review of the Manistee area water pollution problem at the July 24, 1970 meeting of the Water Resources Commission. Enclosed is a copy of the transcript of that review and the discussion pertaining to it.

Our letter to you of August 3, 1970 stated the necessity of discontinuing the practice of disposal of strong chloride-bearing wastes to the surface waters of the state by not later than December 1, 1971 and asked that you respond with respect to formalizing that program. Our purpose in writing at this time is to ask that you review your operations and indicate to us what further changes can and will be made to further reduce and eliminate the chloride contamination of surface and ground waters.

The practice of disposal of salt well back-flushings into seepage pits or into the surface waters is no longer acceptable, and is an example of an area in which procedural changes can be made within a short period of time to eliminate this significant source of chloride contamination.

Other areas in which procedures could be improved within the near future are:

1. Improved housekeeping practices in and around plant and well sites.
2. The establishing of production rates for chemical brine wells.
3. Improved monitoring techniques of buried pipe lines and lines traversing Manistee Lake.

We look for your early reply regarding these matters.

SAME LETTER SENT TO
1. MORTON CHEMICAL
2. MORTON SALT CO.
3. STANDARD LIME REFRACTORIES

Very truly yours,

WATER RESOURCES COMMISSION

N. B. RJC

Norman Billings
Assistant Executive Secretary

enc.
RJC/NB/sb
cc: G. E. Eddy
F. B. Frost
G. Liddle, Jr.
K. Childs
R. Courchaine

Statement of the

MANISTEE COUNTY ANTI POLLUTION ORGANIZATION

(MACAPO)

presented by Mrs. Carole Magnus, Secretary

regarding the

Contamination of surface and ground waters

by chlorides in the Manistee area.

Presented to the

MICHIGAN WATER RESOURCES COMMISSION

meeting

July 2[illegible], 1970

Lansing, Michigan

Gentlemen of the Commission:

It is our position that the presence of unnatural amounts of chloride in our ground and surface waters pose a grave threat to water supplies in the Manistee area.

The State of Michigan felt the problem of chlorides in the Manistee area serious enough to detail Mr. Ken Childs to spend the last two years compiling data to identify the source of the problem.

The Federal Water Quality Administration considers the chloride problem in the Manistee area of sufficient magnitude to schedule a detailed survey this summer of the waters of the Big Manistee River, Manistee Lake and Lake Michigan, in the vicinity of Manistee. The Federal Water Quality Administration takes the position that chlorides must be controlled in Lake Michigan since much of the drinking water in the Lake Michigan watershed area will eventually be derived from this lake.

On July 15, 1970, Mr. Childs attended a special meeting of Manistee city officials. At this meeting he suggested that if the City was contemplating increased use of water that they look to Lake Michigan or the Big Manistee River.

Basically, we agree on a single item; that being that chlorides must not be allowed to further contaminate our remaining water supplies.

The next logical step is to determine the most expedient method by which to eliminate chlorides from contaminating our surface and ground waters. In our letter of June 13, 1970 to Mr. Ralph Purdy, we asked that a Cease and Desist order be issued by the MWRC to stop all chloride dumping into Lake Michigan, Manistee Lake, the Big and Little Manistee Rivers, and any land area of Manistee County where seepage or process of osmosis would allow chlorides to contaminate adjoining waters and/or properties above the Sylvania level. In Mr. Purdy's letter to me of June 18, he advised that our letter would be presented to the MWRC at their June 1970 meeting. Thus far we have received no specific answer to our request.

In our letter, we offered three possible solutions to the problem. In a Federal Health, Education and Welfare study made in August of 1963, this study (advises that two industries in Manistee, at that time, were returning 7.12 million gallons daily of waste brines to deep wells.

However, this statement is seemingly contradicted by Mr. Norman Billings letter of October 7, 1963 to Mr. H. Schindler wherein Mr. Billings states that "the Manistee Salt Company discharges approximately six and three-quarters of a million gallons per day of waste containing about 0.08 per cent chloride into Manistee Lake."

In 1959 Orders of Determination regarding disposal of chlorides to surface waters were issued to Standard Lime & Refractories, Great Lakes Chemical (now inoperative) and Morton Salt and Chemical in amounts totalling approximately 1,500,000 gallons per day.

However, no Order of Determination was issued to Manistee (Hardy Salt) for their discharge of brines to surface waters per our discussion with Mr. George Liddle at our meeting May 28, 1970. One would logically ask "what does Manistee (Hardy) Salt do with their waste chlorides?" if the State of Michigan has refuted the statement by the Federal HEW report that 7.12 MGD of waste brines are returned to deep wells.

We know for a fact that Hardy Salt has for some time been dumping vast tonnage of waste chloride blocks into their ash pit from whence they are washed back into Manistee Lake. In a letter from Mr. Allen Vinfield, Vice President of Production at Hardy Salt to me dated July 2, 1970, our organization was assured that an alternate disposal method had been adopted by Hardy's and that no more waste chlorides will enter Manistee Lake from this source.

In Mr. Gerald Eddy's letter of November 20, 1963 to Mr. H. Schindler he states that Standard Lime and Cement is seriously considering the return of brines to wells.

One further point of extreme concern to us and the Federal Water Quality Administration is the ultimate effect these chlorides will have on the water quality of Lake Michigan. The State-Federal standard on chlorides in Lake Michigan is 50 mg/l. However, our own water samples taken in the vicinity of the outfall and analyzed by a private laboratory, show a chloride level of 220 mg/l in May of 1970.

In Mr. Ralph Purdy's letter to Mr. H. Wm. Butler of September 22, 1964 Mr. Purdy quotes the Packaging Corporation of America as follows:

> "The effluent touching the shore was quite dilute, testing only .144 ppm chlorides whereas the brine-effluent mixture will run 7M - 12M ppm."

This would seemingly be a gross violation of State-Federal standards and a possible violation of the Federal Water Quality Act of 1965.

With all of these facts before you and realizing that by law the Michigan Water Resources Commission must make the ultimate move to stop further chloride contamination of surface and ground waters, our organization demands answers to the following questions.

1. The date when the Cease and Desist order on all chloride disposal as outlined in our letter of June 13 will be issued?
2. What methods the MWRC will employ to ensure that no illegal chloride disposal will occur?
3. What schedule of financial penalties will be adopted and rigidly enforced for any and all illegal or accidental dumping?
4. What schedule of regular State and industrial pipeline and well inspection will be adopted to ensure that corrosion or age of pipe will not permit leakage and subsequent chloride contamination?

5. Why did the State of Michigan find it necessary to establish a maximum allowable chloride level in intra-state waters so much higher than the other three Conferees in the Four State Lake Michigan Enforcement Conference?

Gentlemen; MACAPO will appreciate receiving your answers to these questions at the earliest possible time. Thank you.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Division of Water Supply and Pollution Control

Aug '63

STAFF REPORT

MANISTEE RIVER (MICHIGAN) and LAKE MICHIGAN

The City of Manistee discharges treated domestic waste effluent in the Manistee River System with a population equivalent (P.E.), measured in terms of biochemical oxygen demand, of 1915, one mile above the mouth of the Big Manistee River. Other domestic waste discharges are of relatively minor importance. Industrial waste discharges are significant. Paper and food products plants located near the mouth of the river system have a waste discharge of almost 15,000 P.E. measured in terms of biochemical oxygen demand. Chemical and salt discharges from industries in this area also contribute to pollution of the river system. A total of 3.12 million gallons per day (MGD) of organic wastes and 0.71 MGD of chemical and brine wastes are discharged to the Big and Little Manistee Rivers by industry. An additional 7.12 MGD of brine wastes are discharged into deep wells by two of the industries.

Water quality studies have been made at the mouths of the Manistee and Little Manistee Rivers, on Manistee Lake, and on Lake Michigan in the vicinity of the mouth of the Manistee River during the month of August, 1963. These preliminary survey results show that the total solids content in the Little Manistee River is 180 parts per million (ppm). This indicates that the industrial waste discharges to this stream do not affect it significantly. The Big Manistee River is affected by the industrial waste discharges, as indicated by the total solids content range of 300-500 ppm. Ninety percent of the total solids in the Big Manistee River are dissolved solids, largely of industrial origin. The effect of industrial waste discharges is further indicated by the presence of chlorides ranging from 37-266 ppm, in the Big Manistee River. Compared with the 5 ppm chlorides in the Little Manistee River, the increase seems significant. The Public Health Service Drinking Water Standards have a recommended limit for chlorides of 250 ppm in a water supply before treatment.

One of the two sampling stations on Lake Manistee (#20) shows a wide variation in water quality, depending on the depth of the sample, although the number of samples taken precludes any extensive interpretation. Similarly, the connecting channel from Lake Manistee to Lake Michigan has significant variations, depending on the depth of the sample, based on the one sampling period. The condition at the 10 meter depth in particular reflects conditions inimical to good fish and benthic life development.

In order to determine the overall effect of the Manistee River System on Lake Michigan, 9 sampling stations were established in the immediate vicinity of the river's mouth. Samples taken from various depths show an area of questionable water quality southward along the shore of Lake Michigan from the harbor mouth.

At three sampling stations located inshore off the harbor entrance, some variation from normal lake water quality is reported. Normal lake water quality is reported at Station 24, located approximately 2.5 miles south of the harbor and 0.5 mile from the shore.

An increased organic load was discharged to Lake Manistee and the channel from the Packaging Corporation of America at Filer City for a period this past summer, due to a breakdown in the plant.

All the discharges from the various industries and municipalities in the Manistee area are under the jurisdiction of the Michigan Water Resources Commission.

STATE OF MICHIGAN
WATER RESOURCES COMMISSION
GEORGE W. ROMNEY, GOVERNOR

STAFF OFFICES
200 Mill Street
TEL. 373-3560
STATION B
LANSING 13, MICHIGAN

COMMISSION
MICHAEL E. MIATECH, Lansing, Chairman
Conservation Groups
GERALD E. EDDY, Vice Chairman
Director of Conservation
ALBERT E. HEUSTIS, M. D.
State Health Commissioner
JOHN C. MACKIE
State Highway Commissioner
GEORGE S. McINTYRE
Director of Agriculture
ES S. GILMORE, JR., Kalamazoo
Industrial Management Groups
GEORGE F. LIDDLE, Muskegon
Municipal Groups

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Attorney General

STAFF
LORING F. OEMING
Executive Secretary
NORMAN BILLINGS
Asst. Executive Secretary
Chief, Hydrology Division
RALPH W. PURDY
Chief Engineer
JOHN L. DESMOND
Office Manager

Copies sent
to H.W.B.
R.S.
C.L.
S.D.

October 7, 1963

Mr. H. Schindler, Jr.
Executive Vice President & General Manager
White Star Trucking, Inc.
1750 Southfield
Lincoln Park, Michigan

Dear Mr. Schindler:

We regret the delay in answering your letter of September 6, regarding Manistee area water problems.

An investigation including sampling at times when you experienced difficulties at your Lake Michigan property this past summer would have been most valuable in identifying the offending substances and we certainly wish we had been called at the time you noticed the unsatisfactory conditions reported in your letter.

A report on studies made to determine the feasibility of disposal of the Company's waste with brine was received from the Company a few days ago and we have not had an opportunity to review the report in detail. The admixture of brine would be to increase the waste's specific gravity and keep it from moving to the water surface or the shallows. Tests of this principle using hauled brine have been very successful. A meeting between the Water Resources Commission staff and Company people is to be arranged to discuss the report and other phases of the waste disposal problem sometime during the week of October 21. The brine which would be used in such a project would be a portion of that which is presently disposed of to the Manistee channel through a pipeline and eductor system built jointly by Great Lakes Chemical Corporation, Standard Lime and Cement Company and Morton Salt Company in 1961. This disposal method for the spent brines was adopted by the Companies to reduce the discharge of chlorides to Manistee Lake and is being done under Orders of the Water Resources Commission with restrictions on the discharges. These Orders also require the routine filing of reports. The Companies have maintained compliance with the terms of the Orders. Discharge through the disposal system averages about one and one-third million gallons per day of brines containing about 10 per cent chloride. No reaction would be expected to occur between the inert waste brines and the Packaging Corporation wastes which contain small amounts of wood sugars, tannins, ligrins and cellulose.

The Manistee Salt Company discharges approximately six and three-quarters of a million gallons per day of waste containing about 0.08 per cent chloride into Manistee Lake. The effects of these discharges and those of Packaging Corporation on Manistee Lake have been evaluated and have not been determined to create conditions of unlawful pollution.

Enclosed is a copy of Act 245, P. A. of 1929, as amended by Act 117, P. A. 1949 which you requested. We realize that not everyone is in accord with the statutory definition of unlawful pollution; however, as you realize, we must work within the scope and authority of the present statute. While we have been unable to demonstrate unlawful pollution of Lake Michigan waters at Manistee we realize that it is not possible for our surveillance to be on a sufficiently frequent and regular basis to provide assurance that we have observed the lake conditions under all situations of weather, and of variations in waste flow and water quality.

We feel some confidence that the forthcoming meeting will result in early and substantial improvements. If it does not, the matter will be scheduled for attention by our Commission.

Very truly yours,

Norman Billings

Norman Billings
Assistant Executive Secretary

RJC:bmc
cc--R. J. Courchaine
Enc.

DAILY DISCHARGE

PACK. CORP.	10,000,000	GALLONS
GRT LAKES CHEM STD. LIME MORTONS	1,333,333	GALLONS
MANISTEE SALT	6,750,000	GALLONS
	18,083,333	GALLONS PER DAY

2011

MICHIGAN
DEPARTMENT OF CONSERVATION
LANSING

GERALD E. EDDY
DIRECTOR

NOV 25 1963

November 20, 1963

Mr. H. Schindler, Jr.
Executive Vice President
and General Manager
White Star Trucking, Inc.
1750 Southfield
Lincoln Park, Michigan

Dear Mr. Schindler:

I delayed an earlier reply to your letter of October 22 because I wished to discuss aspects of the Manistee River situation with members of my own staff as well as with members of the staff of the Water Resources Commission. As you probably know, as Director of Conservation I am a member of that body.

The Packaging Corporation of America is under orders of the Commission to remove freely settleable and floating solids, to maintain specified oxygen levels, and not to impart objectionable odor, color, or turbidity sufficient to interfere with the development of public water supplies or with other industrial enterprise or other lawful occupation including recreational uses as to injure fish or aquatic life.

The Commission is well aware of the problems that exist in the Manistee area and have been pressing the company for additional corrective measures. I believe that a recent meeting has been held with top-level officials of the company, but I have not been advised as to the outcome. Inasmuch as I am sending a copy of this reply to Mr. Oeming, Executive Secretary of the Commission, perhaps he can write an additional letter to you concerning that meeting.

As you may know, the chlorides in Manistee Lake have been greatly reduced due to Water Resources Commission orders and despite some comments originating from the Public Health Service that it produces conditions inimical to good fish and benthonic life. There have been no instances of actual injury reported. Also I am advised that the Standard Lime and Cement Company is seriously considering underground disposal of some of their waste brine that goes into the Manistee Lake outlet.

Sincerely,

Gerald E. Eddy

Gerald E. Eddy
Director

GEE:ch

cc L. F. Oeming

STATE OF MICHIGAN
WATER RESOURCES COMMISSION
GEORGE W. ROMNEY, GOVERNOR

COMMISSION
IRVING H. RONK, Chairman
or JOHN C. MACKIE
State Highway Commissioner
GERALD E. EDDY, Vice-Chairman
For RALPH A. MAC MULLAN
Director of Conservation
ALBERT E. HEUSTIS, M.D.
State Health Commissioner
GEORGE S. McINTYRE
Director of Agriculture
JIM GILMORE, JR., Kalamazoo
Industrial Management Groups
GEORGE F. LIDDLE, Muskegon
Municipal Groups
LYNN F. BALDWIN, Eaton Rapids
Conservation Groups

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Executive Secretary
NORMAN BILLINGS
Asst. Executive Secretary
Chief, Hydrology Division
RALPH W. PURDY
Chief Engineer
JOHN L. DESMOND
Office Manager

SEP 23 1964

September 22, 1964

Mr. H. William Butler
Clark, Klein, Winter, Parsons & Prewitt
Counselors at Law
2850 Penobscot Building
Detroit, Michigan 48226

Mr. H. Schindler, Jr.
Executive Vice President
White Star Trucking
1750 Southfield
Lincoln Park, Michigan

Gentlemen:

We have recently received a report from the Packaging Corporation of America, Filer City, regarding their observations of conditions along the Lake Michigan shoreline and the operation of the new waste brine addition to their wastes discharged through the Company's Lake Michigan pipeline since this system was put in operation on August 15.

Following are their comments:

1. "During periods of calm, or light winds from any direction up to 4 MPH, we can find no trace of the effluent either on the beach or in the form of a streak visible from shore or from an airplane. Formerly these conditions would generally form a puddle of effluent which would touch shore at some point.

   No odor is apparent under the above conditions.

2. When there is a appreciable wind, above about 10 MPH from the quadrants of South to West or West to North, there is a visible streak out in the lake downwind from the spargers. The streak becomes apparent about 500 to 600 feet downwind and is apparently caused by wave motion bringing up the effluent from the bottom strata. The streak is generally less dark than formerly due to better diffusion and in S or SW winds is almost always completely dispersed before it hits the Manistee breakwater. So far it has never touched the shore.

   Odors on shore are generally less pronounced and are much less frequent than prior to the brine addition.

3. An East wind (approx. 7 MPH) on one occasion was found to bring the effluent into shore along our property but had no tendency to move it North or South to the other property owners' shoreline. The effluent touching the shore was quite dilute, testing only 144 ppm chlorides whereas the brine-effluent mixture will run 7 M to 12 M ppm."

If you have had an opportunity to observe conditions since August 15 we would appreciate your comments and knowing whether you confirm or concur in the observations of the Company.

Very truly yours,

Ralph W Purdy

Ralph W. Purdy
Chief Engineer

RJC:bmc
cc--C. Harvey

MANISTEE COUNTY ANTI POLLUTION ORGANIZATION
(MACAPO)

Box 282
Manistee, Michigan 49660
September 1, 1970

William G. Milliken
Governor
Executive Office
Lansing, Michigan 48926

Dear Governor Milliken:

Please find enclosed copy of our letter to Mr. Ralph Purdy of the Water Resources Commission.

Our organization is of the opinion that the State of Michigan can no longer allow the industries in the Manistee area to set their own standards regarding air and water quality.

The Water Resources Commission has set a tentative target date of December 1, 1971 for the elimination of concentrated chloride disposal to the surface waters in the Manistee area. We feel that this date is much too far in the future, and only a tentative date at that.

There is roughly 1,900,000 pounds of chlorides entering the surface waters in the Manistee area every day. That means that until December 1, 1971 these chloride polluting industries will be legally allowed to dump over ONE BILLION pounds of chloride contaminants into someone else's drinking water.

We forwarded a copy of our June 13, 1970 Cease and Desist request on chloride disposal to you. MACAPO outlined three possible methods that would eliminate chloride disposal to surface waters. The Water Resources Commission has chosen to ignore our suggestions, which would have eliminated chloride disposal to surface waters within 30 days.

It is immoral enough for Manistee industries to pollute someone else's drinking water, but to continue to pollute when economic and expedicious methods are available to correct this pollution is a heinous act.

Very truly yours,

Carole Magnus
Mrs. Carole Magnus, Secretary
MACAPO

DEPARTMENT OF THE ARMY

PERMIT NO 56-56-3

NOTE.—It is to be understood that this instrument does not give any property rights either in real estate or material, or any exclusive privileges; and that it does not authorize any injury to private property or invasion of private rights, or any infringement of Federal, State, or local laws or regulations, nor does it obviate the necessity of obtaining *State assent* to the work authorized. IT MERELY EXPRESSES THE ASSENT OF THE FEDERAL GOVERNMENT SO FAR AS CONCERNS THE PUBLIC RIGHTS OF NAVIGATION. (See *Cummings* v. *Chicago*, 188 U. S., 410.)

10—13153-3

PERMIT

Office of the District Engineer
Detroit District, Corps of Engineers.
Detroit 26, Michigan
NOV 20 1956 , 19

American Box Board Company
Filer City, Michigan

Sirs:

Referring to written request dated 10 August 1956

I have to inform you that, upon the recommendation of the Chief of Engineers, and under the provisions of Section 10 of the Act of Congress approved March 3, 1899, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," you are hereby authorized by the Secretary of the Army.

to construct a 24 inch waste outfall extending 1,100 feet lakeward with diffuser at the outer end
(Here describe the proposed structure or work.)

in Lake Michigan
(Here to be named the river, harbor, or waterway concerned.)

at Manistee, Michigan, approximately 4 miles south from entrance to Harbor
(Here to be named the nearest well-known locality—preferably a town or city—and the distance in miles and tenths from some definite point in the same, stating whether above or below or giving direction by points of compass.)

in accordance with the plans shown on the drawing attached hereto marked: "Outfall for Paper Mill Waste Disposal ------ in Lake Michigan ------ County of Manistee, State Mich. Application by American Box Board Co, August 10, 1956."
(Or drawings: give file number or other definite identification marks.)

subject to the following conditions:

(a) That the work shall be subject to the supervision and approval of the District Engineer, Corps of Engineers, in charge of the locality, who may temporarily suspend the work at any time, if in his judgment the interests of navigation so require.

(b) That any material dredged in the prosecution of the work herein authorized shall be removed evenly and no large refuse piles, ridges across the bed of the waterway, or deep holes that may have a tendency to cause injury to navigable channels or to the banks of the waterway shall be left. If any pipe, wire, or cable hereby authorized is laid in a trench, the formation of permanent ridges across the bed of the waterway shall be avoided and the back filling shall be so done as not to increase the cost of future dredging for navigation. Any material to be deposited or dumped under this authorization, either in the waterway or on shore above high-water mark, shall be deposited or dumped at the locality shown on the drawing hereto attached, and, if so prescribed thereon, within or behind a good and substantial bulkhead or bulkheads, such as will prevent escape of the material in the waterway. If the material is to be deposited in the harbor of New York, or in its adjacent or tributary waters, or in Long Island Sound, a permit therefor must be previously obtained from the Supervisor of New York Harbor, New York City.

(c) That there shall be no unreasonable interference with navigation by the work herein authorized.

(d) That if inspections or any other operations by the United States are necessary in the interest of navigation, all expenses connected therewith shall be borne by the permittee.

(e) That no attempt shall be made by the permittee or the owner to forbid the full and free use by the public of all navigable waters at or adjacent to the work or structure.

(f) That if future operations by the United States require an alteration in the position of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army, it shall cause unreasonable obstruction to the free navigation of said water, the owner will be required upon due notice from the Secretary of the Army, to remove or alter the structural work or obstructions caused thereby without expense to the United States, so as to render navigation reasonably free, easy, and unobstructed; and if, upon the expiration or revocation of this permit, the structure, fill, excavation, or other modification of the watercourse hereby authorized shall not be completed, the owners shall, without expense to the United States, and to such extent and in such time and manner as the Secretary of the Army may require, remove all or any portion of the uncompleted structure or fill and restore to its former condition the navigable capacity of the watercourse. No claim shall be made against the United States on account of any such removal or alteration.

(g) That the United States shall in no case be liable for any damage or injury to the structure or work herein authorized which may be caused by or result from future operations undertaken by the Government for the conservation or improvement of navigation, or for other purposes, and no claim or right to compensation shall accrue from any such damage.

(h) That if the display of lights and signals on any work hereby authorized is not otherwise provided for by law, such lights and signals as may be prescribed by the U. S. Coast Guard, shall be installed and maintained by and at the expense of the owner.

(i) That the permittee shall notify the said district engineer at what time the work will be commenced, and as far in advance of the time of commencement as the said district engineer may specify, and shall also notify him promptly, in writing, of the commencement of work, suspension of work, if for a period of more than one week, resumption of work, and its completion.

(j) That if the structure or work herein authorized is not completed on or before Thirty-first day of December, 1952, this permit, if not previously revoked or specifically extended, shall cease and be null and void.

See additional conditions on page annexed hereto and made a part hereof.

By authority of the Secretary of the Army:

PETER C. HYZER
Colonel, Corps of Engineers
District Engineer

ENG FORM 1 SEP 42 1721 (Civil) This form supersedes ED Form 96, dated 1 Apr 35, which may be used until exhausted.

U. S. GOVERNMENT PRINTING OFFICE 10—13155-4

DEPARTMENT OF THE ARMY

PERMIT

(k) That, the permittee shall provide adequate facilities to extract freely settleable solids from the waste water such that the remaining concentration will not exceed sixty (60) parts per million by weight and the total daily weight of discharged solids will not exceed 5,000 pounds. Should the District Engineer find that either the maximum concentration or daily weight of suspended solids is being exceeded, the permittee agrees to take whatever action is necessary to reduce the amount of solids to or below the allowable limits.

(l) That, if it is determined necessary to conduct sampling tests of the waste water to check compliance with condition (k), the permittee agrees to permit ready access to necessary portions of its premises by the District Engineer's representatives for this purpose.

(m) That, should the District Engineer determine that solids discharged from the outfall sewer are causing an unreasonable obstruction to navigation in the vicinity of the outlet, or an increase in the amount of maintenance dredging in the authorized Federal project at Manistee, Michigan, the permittee agrees, upon notice by the District Engineer, to either remove and dispose of the deposit at its sole expense, or reimburse the Federal Government for its cost of removal as determined by the District Engineer.

(n) That, this permit is revocable by the Secretary of the Army should the permittee fail to comply with conditions (k), (l), and (m) within a reasonable period as determined by the District Engineer.

The Manistee News-Advocate

June 7, 1950

Hoffmaster Gives Views on Manistee Fish Kill

LANSING —(UP)— Nature and an industrial plant combined forces to kill millions of fish ranging from shiners to 36-inch trout in Manistee lake, Conservation Department Director P. J. Hoffmaster revealed today.

Fish specialists have spent two eeks investigating the havoc in he four-mile long lake which has eft dead fish in piles along the horeline.

"We believe organic matter umped into the lake by the Amrican Boxboard Company plus naural phenomena combined to delete oxygen in the water and suffoate the fish," Hoffmaster said.

He explained that when there is a jump in temperatures, warm surface water sinks to the bottom.

"In the Manistee lake, it set up thermal currents which disturbed masses of organic matter on the lake bed and pushed them to the surface," He said. "The organic matter absorbed the oxygen and the fish suffocated."

Between 600 and 700 rainbow trout between six and 36 inches have died in the fish kill believed to be the largest in the history of the state. Hundreds of dead pike, bluegills, sunfish, perch, and bass lie along the shore while an estimated 100,000,000 shiners and 150,000 game fish under six inches have died so far.

G. B. Bonfield, Grand Rapids, American Boxboard Company executive, will appear before the Water Resources Commission June 20 to explain the daily dumping of 40,000 pounds of waste matter in the lake.

Hoffmaster said the waste dumped by the plant is roughly comparable to the waste from a city of 250,000 population.

"There's nothing we can do about it now. Even closing the plant down would not help," Hoffmaster said. "Our worry now is that the fish kill doesn't happen again."

.2022

STATE OF MICHIGAN
WATER RESOURCES COMMISSION
GEORGE [illegible] GOVERNOR

COMMISSION
MICHAEL F. MIATECH [illegible], Chairman
Conservation Groups
GERALD E. [illegible], Vice Chairman
[illegible] Conservation
ALFRED E. [illegible]USTIS, M.D.
State Health Commissioner
JOHN [illegible] MACKIE
State Highway Commissioner
GEORGE S. McINTYRE
Director of Agriculture
JAMES S. [illegible], JR. [illegible]
Industrial Management Groups
GEORGE F. LIDDLE, Muskegon
Municipal Groups

[illegible]

STATION B
LANSING 13, MICHIGAN

LEGAL COUNSEL
FRANK J. KELLEY
Attorney General

STAFF
LORING F. OEMING
Executive Secretary
NORMAN BILLINGS
Asst. Executive Sec.
Chief Hydrologist
RALPH W. PURDY
Chief Engineer
JOHN [illegible]

September 20, 1963

Mr. Donald G. Jenrings
Attorney at Law
Board of Commerce Building
Manistee, Michigan

Dear Mr. Jennings:

A copy of your letter of June 7, 1963 to Senator Hart regarding Manistee Lake pollution was received in this office on September 3, 1963 from H. W. Poston, Regional Program Director of the U. S. Department of Health Education and Welfare, Public Health Service, Water Supply and Pollution Control, Region V.

We are concerned with your position that pollution exists and is worsening in the Manistee area waters, and would appreciate it very much if you could provide us with further detail on the conditions to which you allude.

As you may know, very considerable reductions have been made in the wastes going to Manistee Lake, both with respect to the salt brine and the paper mill wastes. A portion of these wastes have been diverted from Manistee Lake, to the Big Manistee River and Lake Michigan which have abundant capacity to dilute the salt and to assimilate the oxygen demanding effluent.

These diversions were initiated and are proceeding under order and continuing surveillance of this Commission, which is the agency charged by state law with the control of pollution.

We would be happy to arrange a meeting with you to discuss waste control and water quality in the Manistee area if you so desire. Our files are also available for your inspection at any time. Please let us know in what way we can be of any assistance to you.

Very truly yours,

Ralph W. Purdy
Chief Engineer

RJC: lm
cc: C. Harvey
R. Courchaine

Manistee

News-Advocate

Manistee, Mich., Wednesday, Sept. 23, 1970

2023
World's
Fresh Water
Salmon Capital

P.E. Society Hears Talk on Waste Control

Manistee-Ludington chapter of the Michigan Society of Professional Engineers had its September meeting last night at Coral Gables-Chippewa Hotel in Manistee and heard a talk by George Liddle, district engineer of the Water Resources Commission in this area.

Some 20 industry representatives from Manistee and Ludington joined members and their guests for a social hour and dinner before the meeting.

After a brief business meeting program chairman Tom Stege introduced George Liddle who gave an informative talk on existing and pending legislation affecting industries and municipalities in their control of discharge of wastes to the natural watercourses of the state.

Liddle also discussed the latest legislation passed which allows individuals to sue industries or municipalities if they feel aggrieved by air or water pollution. He pointed out that, in most cases, the circuit courts having jurisdication will check with the state's regulatory agencies and if the defendant is complying with agency stipulations, the court will probably rule in favor of the defendant.

During an informal question-and-answer period after Liddle's talk, the subject of chlorides in ground waters in the Manistee area was discussed. It was brought out that while high chloride concentrates exist at some well locations in the area, the chloride concentration in the Manistee city water supply is well below Federal water control standards, way below the taste threshold and, therefore, not toxic or harmful in any way to the users.

The pollutants of highest concern to the commission in this area at this time, according to Liddle, are raw sanitary wastes being dumped into Manistee Lake or Manistee River. It was pointed out, however, that the city has completed preliminary engineering and is now vigorously pursuing the acquisition of federal funds for a total program for collection and treatment of sanitary wastes in the Manistee area.

The chapter's next meeting will be in Ludington on Oct. 20, with the program to be announced later.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Division of Water Supply and Pollution Control

2023a

August, 1963

STAFF REPORT

MANISTEE RIVER (MICHIGAN) and LAKE MICHIGAN

The City of Manistee discharges treated domestic waste effluent in the Manistee River System with a population equivalent (P.E.), measured in terms of biochemical oxygen demand, of 1915, one mile above the mouth of the Big Manistee River. Other domestic waste discharges are of relatively minor importance. Industrial waste discharges are significant. Paper and food products plants located near the mouth of the river system have a waste discharge of almost 15,000 P.E. measured in terms of biochemical oxygen demand. Chemical and salt discharges from industries in this area also contribute to pollution of the river system. A total of 3.12 million gallons per day (MGD) of organic wastes and 0.71 MGD of chemical and brine wastes are discharged to the Big and Little Manistee Rivers by industry. An additional 7.12 MGD of brine wastes are discharged into deep wells by two of the industries.

Water quality studies have been made at the mouths of the Manistee and Little Manistee Rivers, on Manistee Lake, and on Lake Michigan in the vicinity of the mouth of the Manistee River during the month of August, 1963. These preliminary survey results show that the total solids content in the Little Manistee River is 180 parts per million (ppm). This indicates that the industrial waste discharges to this stream do not affect it significantly. The Big Manistee River is affected by the industrial waste discharges, as indicated by the total solids content range of 300-500 ppm. Ninety percent of the total solids in the Big Manistee River are dissolved solids, largely of industrial origin. The effect of industrial waste discharges is further indicated by the presence of chlorides ranging from 37-266 ppm, in the Big Manistee River. Compared with the 5 ppm chlorides in the Little Manistee River, the increase seems significant. The Public Health Service Drinking Water Standards have a recommended limit for chlorides of 250 ppm in a water supply before treatment.

One of the two sampling stations on Lake Manistee (#20) shows a wide variation in water quality, depending on the depth of the sample, although the number of samples taken precludes any extensive interpretation. Similarly, the connecting channel from Lake Manistee to Lake Michigan has significant variations, depending on the depth of the sample, based on the one sampling period. The condition at the 10 meter depth in particular reflects conditions inimical to good fish and benthic life development.

In order to determine the overall effect of the Manistee River System on Lake Michigan, 9 sampling stations were established in the immediate vicinity of the river's mouth. Samples taken from various depths show an area of questionable water quality southward along the shore of Lake Michigan from the harbor mouth.

At three sampling stations located inshore off the harbor entrance, some variation from normal lake water quality is reported. Normal lake water quality is reported at Station 24, located approximately 2.5 miles south of the harbor and 0.5 mile from the shore.

An increased organic load was discharged to Lake Manistee and the channel from the Packaging Corporation of America at Filer City for a period this past summer, due to a breakdown in the plant.

All the discharges from the various industries and municipalities in the Manistee area are under the jurisdiction of the Michigan Water Resources Commission.

2023c

CC: Rep. Cawthorn
Sen. Bouwsma
Gov. Milliken
Sen. Hart
Sen. Griffin
Con. VanderJagt
FWQA

MANISTEE COUNTY ANTI POLLUTION ORGANIZATION
(MACAPO)

Box 282
Manistee, Michigan 49660
August 28, 1970

Mr. Ralph W. Purdy, Executive Secretary
Water Resources Commission
Stevens T. Mason Building
Lansing, Michigan 48926

Dear Mr. Purdy:

To date, the Water Resources Commission has been all too reluctant to set standards, thus letting industry do its own regulating as was the case in the Orders of Determination now in existance covering chloride disposal issued in 1958 and 1959. The pollution of chlorides to Manistee Lake and Lake Michigan continue under these Orders of Determination and in accordance with standards mutually agreed upon, as set by industry.

As a first step, the Orders of Determination should be drastically revised so that a minimum amount of chlorides will be entering Lake Michigan and Manistee Lake. This will give the major chloride polluters something to really shoot for in their efforts to be good citizens and a working part of the community.

By actual test, the large volumes of chlorides allowed to enter Manistee Lake and Lake Michigan have at times exceeded even those maximum levels, thus causing an excellerated degradation of the waters in the immediate area. Thus, it is the intent of MACAPO to set a more optimum standard and to take a more realistic approach to the problem. We request that the Orders of Determination be revised so that a minimum amount of chlorides will be entering the waters by December of 1971, and these should be issued as a standard.

The major chloride polluters are the salt and chemical industries in our area, and our letter of June 13, 1970 gave recommendations which, to date, have been ignored. Mr. Childs surface and groundwater study presented July 24 and subsequent recommendations coincide with our recommendations that these chlorides should be returned to the strata from whence they came. Thus, we feel that with such professional opinion and recommendations, our request for a Cease and Desist should be given immediate consideration. As of the month of August, the WRC has endeavored to capitulate with the request of the Cease and Desist by making a step in the direction of asking industry what they can do to cease the discharge of concentrated chloride wastes into Lake Michigan and Manistee Lake. We of MACAPO are dubious of this particular approach to the problem of asking industry as to what industry will do in the reduction of chloride pollution to Lake Michigan and Manistee Lake. MACAPO wonders if we are not getting back into the rut of 1958 and 1959 where industry stated then what they could do. This has led us to the high parts per million that we now experience in our area. We feel that any step in the reduction of chlorides is a step in the right direction, but we feel that standards should be set by the WRC, rather than by the major chloride polluters.

We realize the economics of such a move, but once again appeal to the WRC to take a very thorough look into the problem and investigate all of the possibilities.

We, therefore, suggest that the largest chloride polluter might revise his process in a minor way to reduce the chloride level.

Therefore, we once again appeal to the Water Resources Commission as laymen, and offer the possible solution of such an economical step to reduce these chlorides. For example:

1. The production of MgO is through a two stage reactor, thus into a series of three settling ponds in which the MgO precipitates out and the chlorides are washed from the MgO, thus giving a pure product to be burned and thus known as Magnesite. It is recommended by us that a simple change in the process of the three settling ponds could easily facilitate the immediate reduction of large concentrated chloride effluents. By decanting the high chloride effluent coming from the first thickener and then washing in the last two thickeners.

2. The present setup at this producer of Magnesite is an AB & C thickener system: These three are compiled of the three stage settling and washing systems and we recommend that one large thickener be placed in operation, thus pumping to the series of smaller thickeners for washing. This material would be pumped by Door-Oliver pumps from the larger thickener and the chloride liquor decanted off and returned to the ground strata from whence it came.

I am sure that the WRC, after a quick review of the process at Standard Lime and Refractories, the Magnesite producer above referred to, might perhaps be able to assist or aid the people with other suggestions in reducing the large concentrated chloride effluents being transported via the 10 inch pipeline to PCA, thus being added with their effluent and transported to Lake Michigan via the 30 inch pipeline.

We would, therefore, appreciate hearing from the WRC on the following:

1. What standards the WRC is setting for positive reduction of chlorides for the December 1971 target date?

2. What standards are being imposed on those chloride polluters of Manistee Lake who have no Order of Determination whatsoever for their chloride disposal?

3. We would like to have an assurance that all concentrated chloride effluent will be eliminated in the waste disposal process of PCA to Lake Michigan by December 1971.

4. We would like to be assured that a drastic revision of present Orders of Determinations will be immediately forthcoming to facilitate the ultimate reduction of concentrated chlorides to Lake Michigan via the lakes, rivers and pipelines in this area by December 1971.

5. We would like to know the schedule and method for monitoring the present and future effluent discharge stations emitting chlorides of any concentration into the waters in the Manistee area during the full 12 months of the year?

6. What monitoring method is the WRC considering for the disposal of salt blocks and salt products now being discharged to the waters in the Manistee area?

After once again hearing Mr. Childs report on August 24 on the degradation of surface and ground waters in the Manistee area, we feel that the problem of chloride contamination is more urgent today than when we wrote our Cease and Desist request on June 13.

Therefore, we implore that a more expedicious and positive approacn be immediately taken to facilitate the maximum reduction of chloride effluents that now contaminate the waters of the Manistee area.

Very truly yours,

Carole Magnus

(Mrs.) Carole Magnus, Secretary
MACAPO

MR. STEIN: May we have Raynor Sturgis?

STATEMENT OF RAYNOR F. STURGIS, JR., DIRECTOR, ILLINOIS DEPARTMENT OF GENERAL SERVICES, SPRINGFIELD, ILLINOIS

MR. STURGIS: Chairman Stein, conferees, ladies and gentlemen. Thank you very much, Mr. Stein, for inviting me to this meaningful and interesting conference.

My name is Raynor Sturgis. I am Director of the Department of General Services for the State of Illinois. I am an engineer by training and have practiced industrial engineering as a consultant in several extractive industries around the country.

The Legislature of the State of Illinois this year granted the Department of General Services appropriations totaling $2,270,000 to engineer and build pollution abatement facilities where they are needed in institutions operated for the State's taxpayers. With this sum it is expected more than 40 sources of air and water pollution will be corrected by the end of next summer.

They include powerplant conversions from coal to oil or gas at mental hospitals, correctional institutions, and armories. A sulphur dioxide extraction device is being engineered for a new coal-burning powerplant at still another State institution.

Your deliberations this week treat alternate waste heat disposal methods for nuclear and fossil fuel powerplants. I judge from the testimony that the cooling tower alternative is projected to cost in the vicinity of $300 million.

The taxpayers for whom I work in northern Illinois are also the purchasers of electric power. Thus, they would face the Illinois share of this expenditure.

Justifying this huge expenditure upon imagined conditions in the year 2000 highlights very well the economic dilemma of pollution abatement. Money needed to improve the air and reduce water pollution around Lake Michigan must be spent to produce results this year and next. The resulting environment should then permit time for the specific research needed to fill in the gaps of information so apparent from differing statements of scientists participating in this workshop this week. This does not mean that using a valuable natural resource as a guinea pig is advocated, or the possibility of irreparable damage is tolerated. This thermal problem is not in this category.

Indications have been cited that sport and commercial fishes may be found in greater numbers in the vicinity of powerplant heat discharges in the fall, winter, and spring to the advantage of people around Lake Michigan.

Should not specific research studies be undertaken to determine how these valuable fish should be repelled during the few weeks in the summer when heat conditions might pose a hazard to the greatly improving Lake Michigan whitefish, salmon, and trout fisheries?

The cost of this research study would represent a small fraction of a $300 million investment for cooling towers. A successful method of regulating fish movement then could be employed by power companies, only when required a few weeks in July and August, to assure preventing damage to the top of the aquatic life chain most important to human beings in the vicinity of fossil fuel and nuclear powerplant sites around the lake.

And since temperature change rather than the presence of heat has been indicated to be significant for aquatic life, is it not possible to design parameters to utilize the lake and still protect fishes? Could this not include relating different amounts of water discharge to their specific temperatures, with outboard motors at one end of the spectrum and powerplants at the other?

Gentlemen, I submit to you — and I am not an aquatic scientist or a limnologist, but I wonder if one of your options should be that you consider development of these questions, or answers to these questions before committing a huge expenditure which time could determine might not be required.

Thank you very much.

MR. STEIN: Thank you, Mr. Sturgis.

Any comment or question?

If not, thank you very much.

MR. STURGIS: Thank you.

MR. STEIN: Herbert Read.

Do you have a copy of your statement?

MR. READ: I have only two copies.

MR. STEIN: Could you give one to the reporter? I would urge anyone, in view of the long day we are having, if he has a copy of his statement, please come up with two, or get one made so you can give a copy to the reporter because it is going to be very trying if she doesn't have it.

MR. READ: As soon as I get back to the office Xerox machine I will get some more.

MR. STEIN: We have one.

STATEMENT OF HERBERT P. READ, STATE DIRECTOR, INDIANA DIVISION, IZAAK WALTON LEAGUE OF AMERICA, CHESTERTON, INDIANA

MR. READ: My name is Herbert Read. I am the State Director of the Indiana Division of the Izaak Walton League and I live in Chesterton, Indiana.

I will try to summarize this statement.

One of the basic points I would like to make is that we who live along the Indiana shoreline of Lake Michigan are particularly concerned over thermal pollution along with the others. This conclusion is due, in part, to a number of factors, some of which I wish to discuss. The dissipating effect of heat, or for that matter any form of water pollution is slow, due to the sluggish movement of water at the southern end of the lake.

I will not elaborate, but the sluggish movement means this water dissipation of heat or other pollutants do occur very slowly, which is a problem for us in Indiana.

It is in this lower basin of Lake Michigan, with the sluggishly rotating waters that most of the electric power generating stations would be located where the heated effluent would be deposited. There has been talk about some 25 or 30 sources of such heat flumes. The power industry would like to restrict us to consider only these stations one by one, increment by increment, and prohibit any thought of the total effect by the year 2000 or beyond. We don't do that and we will not accept that increment-by-increment approach.

I included in my statement a map of the Indiana shoreline, the purpose of which is to show some additional factors which make our problem more difficult, and that is the existence of landfills jutting out into the lake. The northern Indiana Public Service Company generating stations, and their respective discharge flumes are or would be located so that the heated effluent would be trapped by landfills. The effluent with its heat plus whatever other pollutants are included -- and I also discussed a bit of the other pollutants -- will extend along the shoreline of several parks including the Indiana Dunes National Lakeshore. While the uninformed swimmer may enjoy the heated water, the subsequent increase of algae, alewives, and other pollutants from NIPSCO's discharge pipes will turn the beach into something less than desirable.

In the statement itself I describe each of the locations of the generating stations, which I haven't mentioned or gone into a great deal of detail here because you can understand it better visually than for me to describe it, and in the map I have included a red* area which is the probable destination of any heat flumes, and the problem here, of course, is that these heat flumes, with whatever ill effects they have, will be spread along public bathing beaches, public parks, the Indiana Dunes and National Lakeshore, as well as city and State parks.

We had some tests made by the Independant Citizens' Water Pollution Research Associates, Inc., at the Bailly and Michigan city generating stations. At that time we were testing primarily for other forms of pollutants, so we did not go into an extensive heat test. We did make some. We found that the discharge flume was 83 degrees from the Bailly plant, and we could compare this to 66 degrees which was in an area that would be not normally touched by heated discharge -- differences of 17 degrees.

Now, this heated water discharge flume spread along the beach of the Indiana Dunes National Lakeshore. For a mile of the beach it still registered 81 degrees. We didn't go along and make further tests. We will. But I think it is quite obvious that we have special problems, and that is why we want this body to take a hardline stand on it.

*Solid black area

H. F. Read

Mr. Stein, you did say that you did not want discussion of other pollutants, but our experience with other pollutants has a direct bearing on our positions that most of the conservation groups are taking here today, and that is that we have listened to all of the denials of problems by steel companies, chemical companies, oil companies. They denied that oil would be damaging; they denied that pickling liquor from steel mills would be damaging; and now we are expected to accept the notion that we would sit by here and let the generating stations build their plants and then maybe sometime in the dim, distant future, if their pollution can be proved, they will do something about it.

You people have not been able to do anything about the pollution that we have -- very little. We have not been able to do anything about it, and I don't see if we have not been able to have much progress today how we are going to automatically stop this in the year 1975, which was the year that was mentioned.

I think it should be mentioned that the pollutants coming out of NIPSCO, including fused manganese-aluminum-titanium-silicon, commonly called clinker or bottom ash; fly ash; iron II and iron III oxides; nickel; chromium; magnesium; cobalt; and zinc -- some of these materials, particularly the zinc, are more suggestive of steel mill processes, and I understand that some interconnection of piping exists between NIPSCO's Bailly Station and the adjacent Bethlehem Steel Plant. It may be that NIPSCO, as part of its "good neighbor" policy, is allowing Bethlehem to flush some of its untreated wastes of metallic refuse and perhaps also dissolved pollutants and heated water directly into Lake Michigan.

This is the reason why we want to get powerplants -- particularly NIPSCO -- off the lakefront, and it is not just the heat, it is the rest of the stuff that goes along with it.

I will end here. Thank you very much. (Applause)

MR. STEIN: Thank you very much, Mr. Read.

Are there any comments or questions?

If not, thank you very much again for your statement.

(Mr. Read's statement follows in its entirety.)

Reproduced from best available copy.

To: Third Session, Federal Conference on Lake Michigan
and its Tributary Basin , Chicago

From: Herbert P. Read, State Director, Indiana Division
Izaak Walton League of America
M. R. Box 438, Chesterton, Indiana 46304

Date: October 2, 1970

We who live along the Indiana shoreline of Lake Michigan are particularly concerned over thermal pollution problems now being considered. This is because the southern tip of the lake is where most of the pollutants dumped into the lake end up--and where most of them remain. Our state of Indiana is further notable for being the worst polluter for having the least effective enforcement and totally without any form of leadership from any of the local or state governmental units to correct the problem.

In short, we have a helluva mess on our hands, and if the so-called public utilities get their way, we might as well start carving the tombstone for the Indiana shoreline of Lake Michigan right now.

This conclusion is due, in part, to a number of factors, some of which I wish to discuss. The dissipating effect of heat, or for that matter any form of water pollution is slow, due to the sluggish movement of water at the southern end of the lake. The littoral drift parallel to the shore moves both east and west, with a net westerly direction. The effect is to hinder northward movement, which when it does occur, upon reaching the underwater ridge near Milwaukee,.usually rotates around to return most of the same water to our shore. I think most of us are familiar with this fact, and there is no need for documentation.

It is in this lower basin, with the sluggishly rotating waters that most of the electric power generating stations would be located and where the heated effluent would be deposited. The power industry hired-hand scientists talk unconcernedly about the little fishes that cavort gleefully in and out of a heat flume which always has sufficient cold water around to quickly reduce it all down to normal temperatures. Conveniently ignored is the cumulative effect of 25 or 30 sources of such heat flumes, ringing the sluggish waters, already rich in nutrients, of lower Lake Michigan.

In common with the Atomic Energy Commission, the power company spokesman would restrict us to considering the effect only increment by increment, and prohibit any thought of the total effect by the year 2,000 or beyond. This is because the total cumulative effect, if known, could make the natives restless.

The movement of water along the Indiana shore is further hindered by the existence of landfills jutting out into the lake. The NIPSCO generating stations, and their respective discharge flumes, are--or would be--located so that the heated effluent would be trapped by landfills. The effluent with its heat, plus whatever other pollutants are included --and I will submit proof of other pollutants--will extend along the shoreline of several parks including the Indiana Dunes National Lakeshore. While the uninformed swimmer may enjoy the heated water, the subsequent increase of algae, alewives, and other pollutants from NIPSCO's discharge pipes will turn the beach into a rotting, stinking morass.

I have included a map for reference. Consider first the existing coal fired 608 MW Bailly generating station. The Bethlehem Steel landfill is directly to the west, prohibiting any dissipation of water pollution westward. It is in fact a pollution pocket, with the heat and other pollutants spreading eastward along the beaches of the Indiana Dunes National Lakeshore, immediately adjacent to the discharge flume.

On August 18 and 26, 1970, a series of tests of various types of pollutants were made by the Independent Citizens' Water Pollution Research Associates Inc. at the Bailly and Michigan City generating plants of NIPSCO. On August 26, the temperature off the Bailly Station discharge flume was 83°F, compared to 66° in the Buffington Pier area, a difference of 17°. The heated water, spreading along the beach of the Indiana Dunes National Lakeshore registered 81° along the first mile of park shoreline. At this rate, it would take several additional miles to return to normal lake temperatures. To make matters worse, a new nuclear fired 657 MW capacity station is planned for this same site for a station total of 1,260 MW. The additional heat load will create quite a "hot spot" in the National Lakeshore.

Simultaneously, hard on the eastern boundary of the Indiana Dunes National Lakeshore is the discharge flume of NIPSCO's Michigan City station. In addition to the existing 208 MW units, a 511 MW unit (station total 719 MW) is being built, to be followed by another of similar capacity, some 1,230 MW, with a discharge of (507,000 gpm plus 350,000 gpm) 870,000 gpm. The discharge would be, by company figures, 14½° above intake temperature, and some evidence exists that the company figures are understated. The heated effluent from this station would be directed westward onto the beaches of the Indiana Dunes National Lakeshore.

Thus both ends of the main section of the National Lakeshore would be blanketed by heated discharged, to the point, if expansion continues at the present rate, the flumes would join , making continuous along the shore whatever ill effects and problems are associated with the discharges.

But even with the aforementioned sources, the Indiana Dunes National Lakeshore and its users may suffer additional abuses from NIPSCO. A new station is planned for Gary, again to be located adjacentto a landfill---this one being United States Steel Company's. The heated effluent, again located in a "pollution pocket," would spread eastward, past the Gary Marquette Park beach to the West Beach unit of the Indiana Dunes National Lakeshore, which will be the heaviest use area. After blanketing this beach, it will be stopped on the east by the Midwest Steel Co. landfill, again polluting a "pocket" of water.

But we're not through with this problem of trapping heated effluent between landfills. At the Illinois-Indiana state line is the Commonwealth Edison State Line Generating Station. A few miles away the Inland Steel Company landfill forms another "pocket" with the Hammond and Whiting beaches in between. The chances for cleaning up these poor, forlorn segments of the public realm would be forever lost with more and more heated effluent.

One more source of NIPSCO's contribution to heating up Lake Michigan is the Mitchell Station, near the eastern edge of Gary, and the only station not adjacent to a public beach

I think you will now agree that the combinations of geography, landfills, and NIPSCO's generating station locations pose a very serious pollution problem for the Indiana shoreline. But NIPSCO's threat to the well being to Indiana's citizens does not end here.

For some unexplained reason, NIPSCO's discharges into the public waters contain other contaminents. These include fused manganese-aluminum-titanium-silicon, (commonly called clinker or bottom ash); fly ash; iron II and iron III oxides; nickel; chromium; magnesium; cobalt; and zinc. Some of these materials, particularly the zinc, are more suggestive of steel mill processes. I understand that some interconnection of piping exists between NIPSCO's Bailly Station and the adjacent Bethlehem Steel Plant. It may be that NIPSCO, as a part of its "Good Neighbor" policy, is allowing Bethlehem to flush some of its untreated wastes of metallic refuse, and perhaps also dissolved pollutants and heated water directly into Lake Michigan.

This is another reason why we want to get power plants--particularly NIPSCO--*off* the lakefront.

Another factor which shapes the response of Indiana conservationists is the unreformed, 19th century management attitude towards pollution problems. NIPSCO's public relations men talk impressively, but we have been on the scene long enough to compare promise with performance. A public utility enjoys a government-protected monopoly, with protective rates which assure stockholders of generous profits. There is no excuse whatsoever for the resistance we have experienced in Indiana, and which is very evident this past week at these hearings.

As expected there are threats of "Brownouts" and "Blackouts." If we permit the power lobby to blackmail the public in this fashion, the same tactic can, and will, be used to excuse other pollution problems in addition to the heated water. In fact, virtually any sin can be rationalized in this manner. The fact is, of course, that the "blackout" tactic assumes a false alternative--that the choice is between using Lake Michigan as a "heat sink" or being without sufficient generating capacity. When pressed on the true alternatives, even the power companies will agree that power can be produced without dumping heated water in Lake Michigan. The true question is the cost, and we have yet to get an honest statement of the cost of preventive measures from the utilities.

We have also heard from "experts" paid by the polluters claim that heated water really is no pollution problem. We are told that until proven otherwise, the heated discharge should be permitted. At some future date, after tests conducted by, and for, the polluters, if it can be proven to their satisfaction that there is danger, maybe--just maybe--something should be done about it. Whatever shortcomings we conservationists have, we're not dumb enough to accept that ridiculous argument. We have heard the same denial of danger from steel companies and oil companies, and recently I heard a Ph.D. hired by the Agricultural Chemical Industry claim that DDT is not responsible for all those fish kills and dying birds. In fact, he implied, DDT was really good for you and would cure everything from cancer to corns.

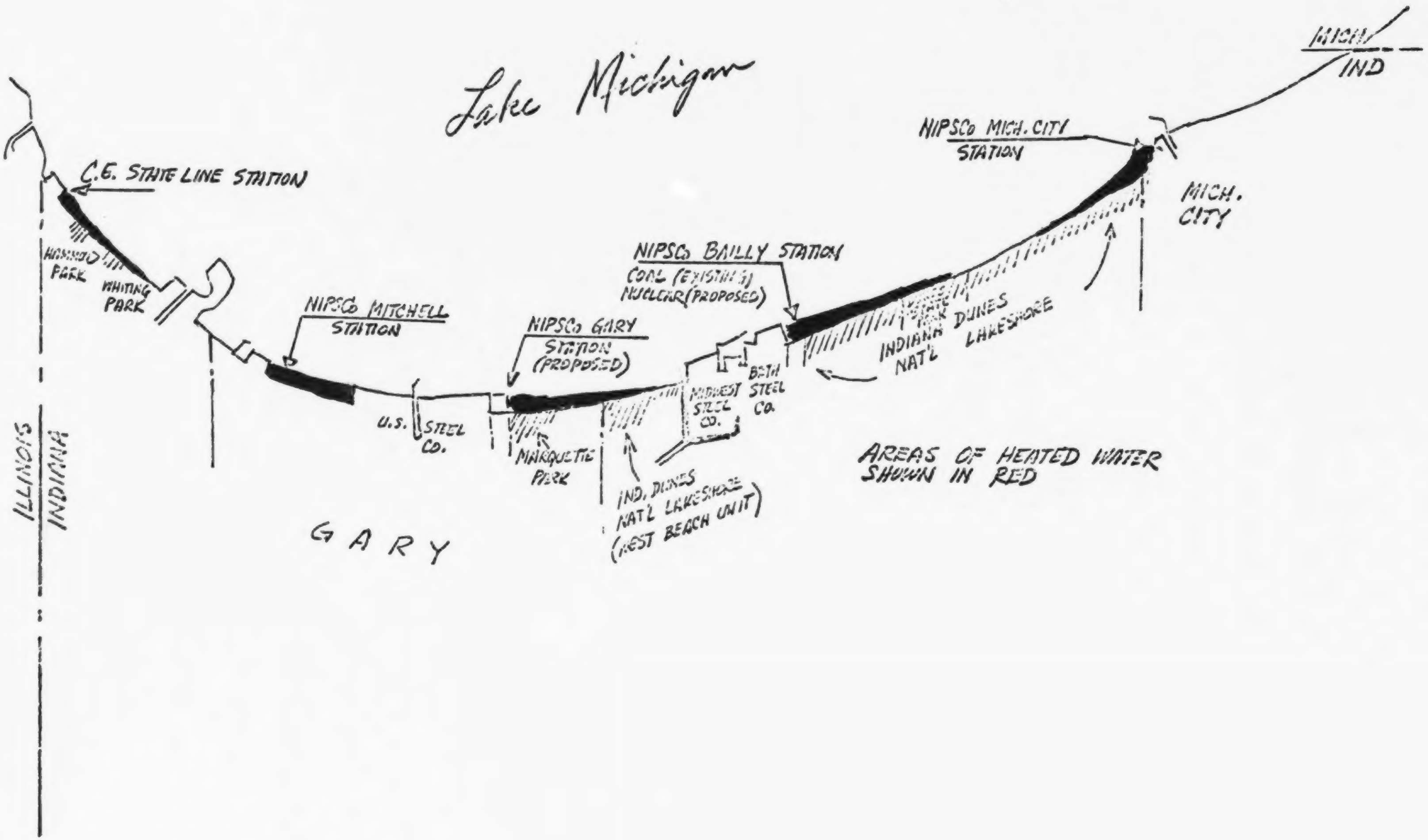
Haven't we learned anything from the past? Do we have to kill off people by the thousands before the polluters will admit the danger of their discharges?

The matter of enforcement must be considered. I am well acquainted with the pollution problems of Northwestern Indiana, and have attended innumerable public hearings and heard excuse after excuse. I have tried repeatedly to obtain local and state action to reduce pollution, and I can state from personal experience that the performance of Indiana authorities does not inspire confidence.

There can be no more delay. The states would dawdle around while the utilities flood Lake Michigan with more and more heated effluent. Even if the states ultimately agree on a policy, I have little confidence that the policy adopted will safeguard Lake Michigan.

There is only one way to go. The U.S. Department of the Interior must require the states to adopt the recommendations as contained in the [redacted]

So called "White Paper" Documents.



AREAS OF HEATED WATER SHOWN IN RED

Mrs. R. A. Barber

MR. STEIN: We have a statement for the record by Mrs. Robert A. Barber who had to leave, and without objection we will enter that as if read.

STATEMENT OF MRS. ROBERT A. BARBER,
DEERFIELD, ILLINOIS

MRS. BARBER: I share the average voter's belief that the lake is a natural resource that can be maintained by sincere efforts at conservation. Those of us who have been interested in the problems created by pollution are pleased that the State of Illinois has given us an accountable group of citizens to set standards for environmental pollution control.

We plead that the Federal Water Pollution Control Agency propose standards to end the use of the lake as a heat sink by utilities, with the present state of scientific information and engineering technology.

MR. STEIN: We have Seymour Altman, Commissioner of the Highland Park Environmental Control Commission.

Mr. Altman.

FROM THE FLOOR: Mr. Altman will be back shortly.

MR. STEIN: All right. We will call him again, if he misses his turn, and I am not specifying when.

Mrs. Shirley Gruen, Wisconsin Federation of Women's Clubs, has a 3-minute statement. Mrs. Gruen.

STATEMENT OF MRS. SHIRLEY GRUEN, WISCONSIN FEDERATION OF WOMEN'S CLUBS GLENDALE, WISCONSIN

MRS. GRUEN: I will only take about three minutes of your time. I put down the Federation of Women's Clubs because I got a phone call about this conference. I am a member of the Women's Club and I am a conservation chairman of the Glendale, Wisconsin Chapter, but I don't really have anything in writing.

I would rather -- before the 1-degree thermal standard is set, however, I would rather talk as an American citizen.

My name is Shirley Gruen, and I live at 214 W. Mt. Royal Road, Glendale, Wisconsin. I am not a geologist, a biologist, an expert on pollution, I am an artist, and I am speaking here as an American citizen to plea for help in saving Lake Michigan from further degradation.

I have spent every summer of my life since 1923 -- that is the year I was born so you can figure it out, I am 46 years old -- at our home on Lake Michigan 3 miles north of Port Washington.

Everything said here today about the phenomenal change in the quality of water in Lake Michigan is true. There are now very few clear water days. After every storm, enormous amounts of algae are tossed on the beach. Other people have told of this so I won't go into it. I think I am probably the only one in this room who lives close to the color of the lake.

In 1935, before the Port Washington powerplant -- and it is run by the Wisconsin Power Electric Company -- at that time, it was the wonder of the world. People came from all over to see this technological wonder. Now, I want to tell you that it is not very nice living next to a powerplant. As the gentleman before me said, it isn't only the pollution in the water, it is the air, it is the coal, it is the coal boats, it is the dredging of the harbor and the Army Corps of Engineers dumping in the lake. It is a relatively constant pollution.

Ironically, even at the time this electric powerplant was built in 1935, it was not even in the public interest then. We lived 3 miles away and could not get electricity at a reasonable rate. It was not until 1941, through the REA, that we got electricity, and I tell you we were luckier then than we are now to be without the electricity.

I would like to speak here as a private person on the feelings that a private person has --the powerlessness and the helplessness to right the wrongs of pollution that we feel. Technology and production can be great benefits of man, but it becomes apparent that they are mindless instruments, and if undirected they move with a momentum of their own and destroy everything in their path --the landscape, the environment, the quality of life. We can't excape it.

They begin to dictate how we are to live. The slogan in Wisconsin -- I don't know if it still is -- I don't listen to that much TV -- was: "Live better electrically." Well, I am not living better electrically; I am living worse electrically. If it means that I have to go without any electricity in my house for the moment I will do it, because what kind of a life is it to live inside a house with every comfort and convenience and not be able to walk outside and enjoy the environment?

So that is about all I have to say. except that as a citizen and as a mother of three children about the ages of some of the children out there, you have to ask yourself as you go through life: "What is your aim in life?" The environment has been very good to me in my years on Lake Michigan, and my aim in life is to pay a little rent, and I am going to do everything that I can as a single person in this world to try to save it.

Thank you. (Applause)

MR. STEIN: Thank you.

Are there any comments or questions?

If not, Mary Helen Dunlop also has a 3-minute presentation.

FROM THE FLOOR: Mr. Chairman, may I ask a question?

MR. STEIN: Will you come up, Mrs. Dunlop?

I wish the power companies here could distribute some of those electric clocks so people would know when their 3 minutes are up.

STATEMENT OF MARY HELEN DUNLOP,
EVANSTON, ILLINOIS

MRS. DUNLOP: Mary Helen Dunlop, a private citizen from Evanston, Illinois.

I came down here today to listen, and also to make a statement of my own for myself and for other people whom I think are of like mind.

When I arrived here, I was told that Mr. George

Brown, representing the Committee on Lake Michigan Pollution, had prepared a statement for that committee and was unable to be here. So I will ask permission to forego presenting my own statement in favor of presenting Mr. Brown's statement for the Committee on Lake Michigan Pollution of which I am a member.

Is that agreeable, Mr. Stein?

MR. STEIN: I take it that is no longer a 3-minute statement.

MRS. DUNLOP: I will take longer than that.

MR. STEIN: Thank you. Go right ahead.

STATEMENT OF GEORGE BROWN, COMMITTEE ON LAKE MICHIGAN POLLUTION, WILMETTE, ILLINOIS
(PRESENTED BY MARY HELEN DUNLOP)

MR. BROWN: My name is George Brown and I am speaking in behalf of the Committee on Lake Michigan Pollution, Box 583, Wilmette, Illinois. The CLMP is a citizens' organization representing members in 10 communities on the north shore. Our main objective is to eliminate and resist present and future pollution threats to Lake Michigan. The committee provides a structure for the individual citizen to contribute to this objective. We have become more convinced over the 4-year life of our group that on important issues relevant to the lake it is important for the public to be heard since reliance on industrial testimony or from political sources is not representative. We have consulted people with expertise within and outside our organization. However, our testimony today will not be primarily technical in nature; that is clearly not our comparative advantage. We do feel, however, that we can make a contribution to the problem of establishing standards.

Our position concerning thermal standards is as follows:

1. A thermal standard should be stated in a multi-dimensional framework. It is not sufficient to establish standards solely in terms of a single dimension such as some stated increase in temperature level at the point of discharge. Other criteria must be included such as the quantity or pounds of water discharged at a particular temperature increment, the length of time the water is discharged at a given temperature level and amount, the rate of change in temperature level at point of discharge, etc. Reliance on one criteria, although administratively simple, does not reflect strategies which vary the levels of temperature, quantity of water discharge and time period

of the discharge. Since combinations of these dimensions have different ecological effects they must be reflected in any standards. Criteria should also be stated in terms of subregions of the lake as well as for the lake as a total system. Failure to state the criteria in a multidimensional sense denies the complexity of thermal effects on our environment.

2. A complex monitoring system must be included in the establishment of operative thermal standards. This position is based on the following rationale. The amount and quality of information on the effect of thermal pollution on Lake Michigan is not well understood. We are not in a position at the present time to make predictions with some certainty on the effects of increase in temperature level or B.t.u.'s on the ecological system of Lake Michigan, for the near or distant future. Any standards established now would be somewhat arbitrary. We would accept such a standard as an initial benchmark if it is tied to a lake-wide monitoring system.

A monitoring system would provide the means to revise the composite standards. It would also provide a means to provide immediate feedback on ecological changes in the lake. Although there will be many studies published in the coming years which will attempt to show whether thermal effects are significant and their relative magnitude, these studies will not be definitive despite their author's intentions. If a particular study shows no ecologically harmful effects occur at a particular increase in temperature level in a given region that will clearly not be an adequate date base for eliminating thermal standards. A study or even group studies will not reflect the complex interactive effects that occur in the lake. It is only with a continuous monitoring and feedback system that the effect of thermal inputs into the lake can be controlled. Information technology is clearly sophisticated enough at the present time to provide the critical link over time between thermal inputs and ecological changes. This link is critical to any decision-making about thermal standards.

MR. STEIN: Thank you, Mrs. Dunlop, for Mr. Brown.

Any comments or questions? If not, thank you very much.

Some people have asked about getting up when their names are called and if they missed their turn. If you go out to eat and you come back and you discover your name was called, I have got a check system here. Just let one of our staff know and we will call you as soon as possible. In any event, we are going to try not to miss anybody.

Mrs. Paul S. Quigg has a statement of about 4 minutes. Mrs. Quigg.

She is not here?

Mrs. Edgar Wilkinson. Mrs. Wilkinson?

Clyde Mathews? According to the information I have, Mr. Mathews, your statement should take about 5 minutes.

MR. MATHEWS: That is correct.

STATEMENT OF CLYDE MATHEWS, COMMUNITY ACTION TO REVERSE POLLUTION, GARY, INDIANA

MR. MATHEWS: Gentlemen, my name is Clyde Mathews. I am from Gary, Indiana, and represent CARP or Community Action to Reverse Pollution. CARP is a group of local citizens organized in opposition to the proposed construction of a 500-megawatt fossil generating plant planned by NIPSCO or Northern Indiana Public Service Company for the western edge of Marquette Park in Gary adjacent to U. S. Steel Gary Works. We are committed to the protection and improvement of our city's air, water, and recreational facilities.

C. Mathews

An example of the utter disregard of the public by a "public" utility is found in a position paper issued by the Northern Indiana Public Service Company recently. The paper is entitled "Position Paper on NIPSCO's Electric Facilities and the Environment" and states, "... it (electricity) provides economic and beautification benefits to the Nation which far outweigh the effect power installations might have upon their immediate ecological neighborhoods."

As residents of Gary, Indiana, one of the so-called expendable ecological neighborhoods, we take strong issue with this statement and attitude. This statement clearly demonstrates the environmental expediency and irresponsibility which has been characteristic of the power companies in dealing with the communities in which they operate.

We, therefore, demand the Federal and State leadership necessary to protect the natural resources essential for those of us who live in this industrial complex and similar ones elsewhere.

Recognizing the fact that there is much needed research to provide absolute facts as to the effect of thermal pollution, sufficient evidence has been presented concerning the destructive effects of massive dumping of waste heat into Lake Michigan to make it mandatory for this conference to act. Both the Federal and State water pollution control agencies must provide stringent interim standards for waste heat discharge.

In our local struggle with NIPSCO we find again and again that they have no intention of reducing waste heat unless forced to do so. Municipal governments have the responsibility of protecting the health and well being of their citizens. They must have uniform, unequivocal standards upon which to base their local legislation. It is the undeniable responsibility of this conference to provide our cities with these standards.

We, therefore, strongly endorse the Interior Department recommendation that "no significant discharge of waste heat into Lake Michigan should be permitted."

Thank you.

MR. STEIN: Thank you, Mr. Mathews.

Any comment or question? (Applause.)

Mrs. Miriam G. Dahl. Mrs. Dahl, you also have indicated a 5-minute statement.

MRS. DAHL: I took a guess.

STATEMENT OF MRS. MIRIAM DAHL, IZAAK WALTON LEAGUE, WISCONSIN STATE DIVISION, MILWAUKEE, WISCONSIN

MRS. DAHL: I want to express my appreciation, after having to listen to all that you have this week, that you still are willing to listen to us who are legitimate public, and the general public I am representing today amounts to -- I have said 1,500, but it is closer to 2,000 people, so I am sure that all of them will be grateful for your time which you are giving us.

Mr. Chairman, and conferees. The Wisconsin State Division of the Izaak Walton League of America representing some 1,500 citizens of the State of Wisconsin reiterates today the firm stand taken initially against the artificial addition of heat to our waters.

In deference to the mathematical computations that absolute degrees of return temperatures cannot be equalled (though we think this statement is subject to question) we accept the allowance of 1 degree above water temperature given in the statement by Secretary of Interior Walter Hickel as tolerable. We know this temperature can be achieved by more than one method. It is fact.

Mrs. M. Dahl

We do not subscribe to the proposal by the State of Michigan of a 3 degree tolerance using acres of lake water to cool instead of cooling before returning used water to the lake. This method affects a far greater amount of water at varying upward temperatures than would be indicated in a stated 3 degree tolerance.

In a study conducted in Tennessee by James Speakman, tests showed that a 3-degree rise even in the warmer waters has a devastating effect on the hardiest fish natural to that area. Other fish and aquatic life would be affected more quickly.

The Columbia River, famous spawning grounds for our best salmon, has been ruined by atomic thermal additions. A 3-degree rise in river temperature in this nitrogen-rich water killed juvenile salmon in just 90 seconds. That is 1-1/2 minutes. Think of the effect such temperatures would have on the coho salmon, trout and other spawn in Lake Michigan. If a 3-degree temperature is possible, a 1-degree is equally possible.

Cost has been made a strong point. The actual cost to the consumer will not be that great annually. The alternative to that cost may well result in uncontrollable climactic changes, and no lake, ergo, no water. The alternative to this has to be wise use and sensible administration.

In July the National Izaak Walton League of America in convention assembled in Norfolk, Virginia, voted to support Secretary Hickel's 1-degree allowance in thermal addition. Wisconsin State Division supports that decision. And I might say we pioneered the introduction of that into the convention.

Conservationists reach a large segment of the "silent majority" who ask us, "Why is continuance of such malpractice allowed against our environment? How can we stop it?"

It is no longer valid to say that economic feasibility demands such action. We are frequently asked to "face reality" by economists and industrialists. We reply that this reality we face is the spendthrift race to overuse, rape, and destroy our true base wealth which economists state is our true wealth together with people. Everything else follows this first premise.

When we begin with this reality, we come to a far different set of conclusions with a truly realistic value which includes people, a future, esthetics, and social values to make a whole life. Then money takes its proper place in purchasing the necessities, and not as an end in itself. Life depends on water, air, food, natural resources. Save these.

We have heard all the excuses and testimonies to substantiate the inability to meet a 1-degree standard. We say that we can do anything we want to do. We have proved this in outer space and undersea explorations, in creating synthetics (always from natural resources), in medical transplants and other Jules Verne accomplishments. Now, we must attend to our basics. We must make fullest, best use of our rapidly disappearing resources. The "waste-not-want-not" maxim must replace the wanton disregard of single use and discard the rest.

We must depend on such government bodies as yours to guide us to firm National standards with full powers of enforcement to protect our remaining resources. We, the conservation groups, and we, the public sector, urge you to set standards of thermal additions to Lake Michigan at 1 degree above temperature. The fragility of Lake Michigan demands this decision. We hope it will become the standard for all waters.

Thank you.

Respectfully, Miriam G. Dahl. I am Chairman of the State Division, Pollution Abatement Committee of the State of Wisconsin, and have just this year been placed on the National Water Committee for the Izaak Walton League.

(Applause)

MR. STEIN: Thank you, Mrs. Dahl.

Any comments or questions? If not, thank you very much.

We have Mrs. Paul Kaefer.

Harold B. Olin.

Mrs. Robert Herlocker.

FROM THE FLOOR: She will be back.

MR. STEIN: H. R. Thoke.

Mrs. Donald Trump.

STATEMENT OF MRS. DONALD TRUMP, CHAIRMAN, ENVIRONMENTAL QUALITY, LEAGUE OF WOMEN VOTERS OF INDIANA, VALPARAISO, INDIANA

MRS. TRUMP: I will file with you a separate statement. (See P. 2055) This is just from the League of Women Voters of Indiana.

I am now speaking for the Lake Michigan Inter-League Group. It represents 75 local Leagues of Women Voters and the State Leagues of Illinois, Indiana, Michigan, and Wisconsin. Each unit has been working for local, State, and regional environmental management programs which are planned to improve the Lake Michigan Basin. Although other

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Statement to
The Third Session Federal Conference on
Lake Michigan and its Tributary Basin
Workshop on October 2, 1970
by
Mrs. Donald Trump, Chairman Environmental Quality
for the League of Women Voters of Indiana

Our League members' long standing concern on water quality and its conservation has led them to inquire about the problems created by water thermal changes as well as other problems. We have learned that there can be aquatic changes, synergistic effects of heat with possible toxic substances, and that deep lake water seasonal temperature stratifications can have deleterious alterations, by placing a layer of warm water on it. Plus the value of water for drinking, recreation and industrial use decreases at high temperature.

We have also learned about the problems that are presented on cooling water systems, their possible detriment to atmosphere with high construction costs, plus the large areas needed for cooling ponds.

Therefore, on equating what the experts report, where they agree and disagree, our members are saying it is important that the country and the states move cautiously and slowly, with greater safeguards than in the past. Now is the time to evaluate the corrective devices through the present and new technological aids. Because, once new water-using plants are built, it becomes very difficult for states to require expensive alterations.

Further, we believe that when the term nondegradation is used for water standards, it should mean no further man-made degradation. Also, any regional or special area variances in temperature standard requirement allows the problem of competitive cost advantages to develop within industries. If careful planning in locating plants produces a cost advantage when equal standards are applied, then the regulating bodies have succeeded in their function.

Thank you.

aspects of League efforts relate to local or broader problems, as an Inter-League Group, we concentrate solely on the preservation and improvement of the quality of Lake Michigan.

We are encouraged to witness the continuance of the Federal-State Enforcement Conference and to see its concentrated approach to Lake Michigan and its tributaries. We believe that only through this type of regional, interstate, and multi-level governmental action can the necessary complicated solutions to Lake Michigan problems be found and enforced.

Basic to the League approach to the task of improving water quality, the League maintains that no one has a right to pollute public waters and that those who produce wastes should bear the cost of managing them.

The question of placing thermal effluent in the category of pollutants is one that has been thoroughly debated. The premise upon which we base our assumption that thermal effluent, from any source, is a pollutant, is that moment when the thermal additives cause a deleterious effect upon the waters, the natural ecology within the waters, the environment surrounding the waters, or affects the use of the waters by area residents or visitors.

Some authorities cite case after case of fish kill, environmental hazards, or speed-up of eutrophication as a result of thermal additives. Other authorities claim that no proven case of known environmental or other effects can be found. League members can certainly claim no prescience to pick that group of scientists which will turn out to be correct. League members know, however, that the confident casual approach to looming problems has not been successful in any instance in the past. It seems that only after the damage has become an obvious danger has concern and control become visible and too little.

Therefore, we encourage this Federal-State Enforcement Conference to consider the recommendations of the Federal Water Quality Administration which would maintain lake water temperatures as close to natural levels as possible. We believe that American technology can find practical ways of achieving this high goal, thus preventing the addition of at least one type of pollutant to Lake Michigan.

The League supports discharge requirements which we think are necessary for State and Federal enforcement. We find it difficult to see how stream standards could be reached and maintained without setting standards for effluent and monitoring at point of discharge. The use of mixing zones as a component of regulating thermal discharge can complicate the regular measurement procedures and, in certain instances, confuse the possible identity of an unlawful discharger.

We believe that it is good in intent but possibly unrealistic as a solution to require power companies to file contingency plans when applying for construction permits. These plans would outline remedial steps to be taken in case their thermal discharge proves harmful. If a powerplant discharges its thermal effluent into Lake Michigan for a period of some years before cumulative damage is observed, it is possible that an established dependency upon that powerplant by the consumer would necessitate continued functioning of the plant while the contingency plan was reviewed and implemented. How long would that take and what further damage could be caused in that period of time?

Attention has been drawn to some of the recreational benefits derived at the point of discharge by attracting large numbers of warm-water fish. Others have followed this point and have asked about the possible effects of a plant shutdown on this unnatural fauna. Would a false environment be established which would then require maintenance?

Nuclear powerplants are now considered to be the major "new" source of thermal additives. If it is determined that cooling ponds are the preferred technique for cooling the heated water, what are the guarantees that the recreational uses proposed for these ponds will not dangerously expose the users to radioactive leakage? This brings up another subject which is presently full of unknowns and causes conflicting judgment of accumulated data.

League members have studied the questions involved enough to know that there are no easy answers and that simplistic solutions must be viewed in a suspect manner. The ultimate decision this conference reaches will certainly not please everyone. We urge caution and, if necessary, that error be made on the side of prevention. We ask that, whatever the final determination, a realistic and yet firm compliance schedule be arranged, and that continuing enforcement measures be incorporated and applied. We urge that opportunities be automatically given to the public to react and respond to powerplant construction proposals before site work has started.

League members, along with the rest of the citizenry, must take a long hard look at our environment and its growing misuse by growing numbers of people. Perhaps it is time for new judgment values to be made on both population and economic growth. The estimates that the affluent citizens of the United States are responsible for 50 percent of the world's annual consumption of natural resources is frightening rather than satisfying.

We must grow up, we must change, we must make hard decisions. Here, today, is the chance to do this in time to save Lake Michigan.

Thank you. (Applause)

MR. STEIN: Thank you, Mrs. Trump.

Are there any comments or questions?

If not, thank you very much.

(The following document was submitted by Mrs. Trump for inclusion in the record.)

2061

League of Women Voters
LAKE MICHIGAN INTER-LEAGUE GROUP

Thermal Pollution

April
1970

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Thermal pollution is the deleterious change in the normal temperature of water caused by the discharge of waste heat.

"In specific cases where heated water discharges are causing actual death in an aquatic habitat, depressing reproduction and growth of desired species, or degrading the environment to a point where less desirable organisms are favored, then we must consider that thermal pollution exists," says Raymond Johnson, assistant director, Bureau of Sport Fisheries and Wildlife, Department of the Interior.

POWER PLANTS AND THERMAL POLLUTION

The nation's need for electric power is doubling every ten years. Massive use of cooling water to condense steam in power plants is an integral part of the generating process. Almost half the water used in the United States is for industrial cooling, with the electric power industry using about 70 percent of this amount. It is estimated that by the year 2000, the need for water for industrial cooling will equal two-thirds of the nation's natural daily water runoff of 1,200 billion gallons.[1]

A single power plant now in existence requires up to a half-million gallons of water a minute for cooling purposes; running at full capacity around the clock, this would mean 720 million gallons a day. Some of this cooling water evaporates; most of it, however, is returned at a temperature ten to thirty degrees above the temperature of the water from which it was withdrawn.

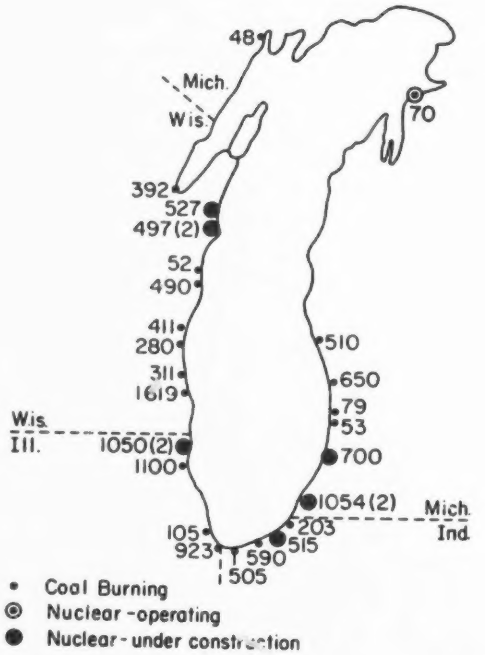
The projected growth of the electric utility industry during the next two decades is expected to require the construction of about 40 new hydroelectric installations of 100 megawatts or more, 50 new pumped-storage hydroelectric installations of 300 megawatts or more, and 90 fossil and 165 nuclear steam-electric plants on new sites.[2]

Nuclear power plants now supply about 1 percent of the nation's power; by the year 2000 they are expected to provide about 50 percent.

THE EFFECT OF INCREASED THERMAL POLLUTION ON LAKE MICHIGAN

There is one nuclear power plant now operating on the shores of Lake Michigan. Nine more are proposed or in process, with all but one scheduled for completion by 1973. The ten plants will have an electrical capacity of 7,100,000 kilowatts.

Major Fossil-fueled and Nuclear Power stations located on Lake Michigan[2]



(Numbers indicate power capacity in megawatts)

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[1] "U.S. Making Initial Move Against Thermal Pollution," by Gladwin Hill, *New York Times*, February 22, 1970.

[2] Joint Committee on Atomic Energy, "Environmental Effects of Producing Electric Power," October, November 1969.

Existing fossil fuel[3] plants, operating at full capacity, discharge an estimated 300,000 billion Btu[4] per year in cooling water to Lake Michigan. Nuclear reactor plants discharge 40 to 50 percent more waste heat per unit of electrical production to the cooling water than do fossil fuel plants. It is estimated that the ten nuclear plants, when in full operation, will discharge 388,000 billion Btu per year to the lake. If all plants, both existing and proposed, were to operate at full capacity (and assuming complete mixing of the entire lake) the temperature of the lake would be raised a little more than 0.06°F annually.[5]

The above calculation assumes no reduction in the heat of the cooling water after its addition to the lake, but actually there will be much reduction through evaporation, radiation and other means. There will, however, be a residual of the added heat that will be cumulative in the lake until an equilibrium is reached at a somewhat higher temperature than that due to natural causes. It is estimated that with an average annual temperature of 50°F for the lake, the added heat would raise the average annual temperature at equilibrium by 0.05°F to 50.05°F. With increasing power production and no off-lake cooling, it is estimated the average annual temperature would be increased by 0.4°F in the year 2000 and by 2.0°F in 2023. This increase would nullify a two degree decrease in average annual temperature of the lake that has occurred, apparently from natural causes, in the past one hundred years.[5]

The possible local effects of increased temperature on aquatic life are cause for more immediate concern than the effect on the lake as a whole. Fish, and the aquatic organisms that serve as their food, are particularly sensitive to variations in natural seasonal temperature during reproductive and juvenile stages.

The value of water for drinking and for recreational and industrial uses usually decreases at higher temperatures. Thermally polluted water is less capable of assimilating wastes. While present use of Lake Michigan waters for irrigation is minimal, local temperature rises in areas near intakes for irrigation water might affect seedlings, plant growth rate, and crop yield. As temperature rises, nuisance plants, algae and rough fish flourish while more desirable life dies. The quality of water deteriorates as foul odors and algal slime appear.

THERMAL POLLUTION AND THE AQUATIC ECOSYSTEM

Thermal pollution can affect the entire ecological balance of natural waters. Water discharged from power plants is often ten to thirty degrees warmer than the body from which it was drawn. A temperature change of only three to four degrees can, under certain conditions, have serious effect upon fish and other aquatic life, depending on the level, duration and rapidity with which the temperature change takes place. Some effects of thermal pollution on the ecological balances of natural waters are:

1) The addition of warm water may cause fish eggs to hatch so early in the spring that natural food organisms are unavailable.
2) Temperature changes act as signals for fish migration and spawning. If hot water from a power plant spreads completely across a river or stream, it can form a thermal barrier preventing fish from swimming upstream to spawn or from passing safely downstream to carry out their life cycle.
3) Trout eggs will not hatch if incubated in water that is too warm, and salmon may not spawn.
4) The sensitivity of aquatic life to many toxic substances is heightened at increased temperatures.
5) Fish double their consumption of oxygen for each ten degree rise in water temperature. As water warms up, it can hold less oxygen, thus lowering the amount of oxygen available to aquatic life.
6) Within certain limits bacterial activity is increased.

In a statement before the Joint Hearings on Atomic Energy, Dr. Johnson said,

> . . . on June 25, 1969, temperature monitors installed by the Federal Water Pollution Control Administration (FWPCA) personnel near the mouth of the Florida Light and Power Company's Turkey Point fossil fuel power plant effluent canal recorded very warm water in Biscayne Bay. At this time biologists recorded high turbidity and evidence of significant kill of bottom living aquatic organisms. Large numbers of dead crabs, pistol shrimp, benthic fish, and dead or dying species of invertebrates and macroalgae were observed. The greatest concentration of dead crabs appeared to extend from the mouth of the Grand Canal into the bay about 1,000 yards.
>
> Further observations on June 28 found a variety of sponges, coral, green algae, crabs and mollusks dead as far out as 1,500 yards. While available data cannot rule out other factors, the most probable cause of death to these organisms was excessive temperature.

THERMAL EFFLUENT AND THE ECOLOGY OF DEEP LAKES

The most dramatic ecological events for deep lakes in the temperate zone are the seasonal turnovers. In the spring, surface waters warm to 30°F, sink and mix with the bottom water, bringing the nutrient-rich bottom water to the surface. The surface waters cool in the fall and again a turnover occurs. The algal blooms which follow these turnovers are well known. The ecology of temperate zone lakes is largely determined by turnovers and by the stratification of the water into layers with varying temperatures during the intervening periods. The chemical, physical, and biological structure of lake ecosystems is keyed to these events. A power plant which places a layer of warm water on a lake surface may disrupt the circulation pattern and either prevent turnovers from occuring or change the time at which they take place. The effects of this on lake ecology can be drastic and possibly disastrous.[6]

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[3] Fuels such as coal, oil, and natural gas.

[4] British thermal unit, the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit.

[5] Statement of F. W. Kittrell, Chairman, Committee on Nuclear Power Plant Waste Disposal, at the Conference on Lake Michigan, U. S. Dept. of Interior, FWPCA, Proceedings, Volume II, February 1969.

[6] "We're in Hot Water", by John Cairns, Jr., in *Scientist and Citizen*, October 1968.

Reported fish kills caused by heated waste water discharges from electric power generation plants

Date	State	Stream or lake	Nearest town or county	Degree of severity	Number of fish killed
Aug. 6-8, 1962	Penna.	Raystown Branch, Juniata River	Saxton	Heavy	3,441
Aug. 11, 1962	Mo.	Discharge canal to Montrose Lake	Ladue	Heavy	Several thousand
Sept. 7, 1963	Ill.	Rock River	Rockford	Light	–
May 28, 1964	Tex.	Unnamed stream	Victoria	Light	–
Aug. 19, 1965	Penna.	Schuylkill River	Reading	Moderate	1,000
Aug. 20, 1965	Ohio	Greater Miami River	Montgomery	–	11,250
Jan. 19-22, 1966	Ohio	Ohio River	Toronto	Light	200
Sept. 2, 1966	Penna.	Schuylkill River	Philadelphia	Heavy	50,000
Jan. 1, 1967	Ohio	Sandusky River	Sandusky	–	300,384
Jan. 17, 1967	Ohio	Sandusky Bay	Erie County	–	78,755
Jan. 1, 1968	Nebr.	Lake Hastings	Hastings	Moderate	5,000
Jan. 2, 1968	Ohio	Sandusky River	Sandusky	–	250,585
Mar. 1, 1968	Utah	Price River	Castlegate	Heavy	150
July 1968	Mass.	Cape Cod Canal	Sandwich	Moderate	–
Aug. 22, 1968	Mass.	Cape Cod Canal	Sandwich	Moderate	–
Dec. 16, 1968	W. Va.	Ohio River	New Cumberland	Light	9,500
Dec. 24, 1968	Ohio	Sandusky River	Sandusky County	–	3,000
June 30, 1969	Fla.	Biscayne Bay	Miami	–	–

Thermal effluents might become a hazard to local aquatic life during the summer months when surrounding temperatures are higher (60-70°) inshore. In the main, however, Lake Michigan is cool even at the height of summer. During the fall and spring overturning of the lake, a thermal bar, or barrier, is established several miles offshore. The bar prevents the inshore and open lake water from mixing, and hence might trap the heated discharge waters and also the fish, because of their reluctance to go through the thermal bar. These close-to-shore effects, however improbable, are possible. The only effective countermeasure would be to shut down, or substantially reduce, the output of the station causing them. If this were to become a recurring phenomenon, serious consideration would then have to be given to use of cooling ponds or towers.[7]

SYNERGISTIC EFFECTS OF THERMAL POLLUTION

Synergism is the simultaneous action of separate agents that, together, have a greater total effect than the sum of their individual effects. In reference to water temperatures, synergistic action refers to the fact that temperature rises increase the lethal effect of many toxic substances to aquatic life forms and may also increase the susceptibility of the fish to disease.

Since domestic and industrial wastes are numerous in the nation's waters, the synergistic action between temperature and toxicity is a relatively common occurrence. Fish kills have accompanied small temperature rises which might have been insignificant in a stream free of toxic substances. Thus the concentration of a substance may be harmless at one temperature, but may contribute to fish mortalities when combined with the stress imposed by higher temperatures. For example, the *myxobacteria Chondrococcus columnaris*, which can cause death through tissue destruction, becomes more virulent as temperature is increased.[8]

OPINIONS ON THERMAL POLLUTION AND THE AQUATIC ECOSYSTEM

Industry. At the Michigan Governor's Conference on Thermal Pollution, July 1969, Wayne L. Wingert of Michigan Electric Utilities reported, "Certainly, in some instances the thermal effects could be detrimental. In other cases, these may well be beneficial; as for example the improvement in oyster growth being demonstrated on Long Island Sound. We know of no problems which have resulted from the addition of heat to the waters of Michigan."

In his report at the same Michigan conference, D. H. Brandt of Consumers Power company said "there appeared to be no gross thermal damage to the benthic (bottom-dwelling) fauna of the main plume area" at their Campbell, Michigan, site on Lake Michigan.

Government Agencies. The Energy Policy Staff, Office of Science and Technology, said in their *Considerations Affecting Steam Power Plant Site Selection*:

> In recent years we have come to realize that injecting huge quantities of heat into a waterway can create a new form of water pollution and for that reason the States, in cooperation with the Department of Interior's Water Pollution Control

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[7] "Nuclear Power and Thermal Pollution," by Philip F. Gustafson in *Bulletin of the Atomic Scientists* (preprint), March 1970.

[8] *Industrial Waste Guide on Thermal Pollution*, FWPCA, Northwest Region, Pacific Northwest Laboratory, September 1968.

Administration, have adopted temperature limitations for the nation's interstate waterways.

The Atomic Energy Commission has no present jurisdiction over the thermal effects caused by the siting of nuclear plants. Many individual state legislatures have adopted water quality regulations. When selecting a site for a reactor facility, a utility must satisfy its particular state that it can comply with these regulations during the operation of the facility.

Based on the data now available and experience with other wastes, it is only prudent that great care be exercised so as to avoid damage to the aquatic environment rather than to plan to correct gross problems after the power industry is heavily committed to the use of facilities which provide little or no control over the effects of their activities on the environment.

The Federal Water Pollution Control Administration has declared that waters above 93°F are essentially uninhabitable for all fish in the United States except certain southern species. Many U.S. rivers already reach a temperature of 90°F or more in summer through natural heating alone. The waste heat from a single power plant of the size planned for the future (some 1,000 megawatts) is expected to raise the temperature of a river carrying a flow of 3,000 cubic feet per second by ten degrees, and since a large number of power plants are likely to be constructed on the banks of a single river, it is possible that many waters would become uninhabitable for fish.

In a book produced by a Wisconsin utility, Dr. Glenn T. Seaborg, chairman of the Atomic Energy Commission, said "Growth of nuclear power will help abate air pollution, reduce traffic and noise in the area surrounding the power plant, and generally make the area a much more attractive and healthier place to be."

A warning was issued by Lee C. White, the head of the Federal Power Commission for most of the Johnson Administration. Mr. White said some expeditious method of resolving disputes over the location of electric facilities must be found. Otherwise, the power industry's ability to supply electricity may, in many locations, soon be outstripped by the apparently endless increases in public demands for electricity. The public will no longer be able to assume "there will be energy at the flick of a switch."

PUBLIC OPPOSITION TO NUCLEAR PLANTS

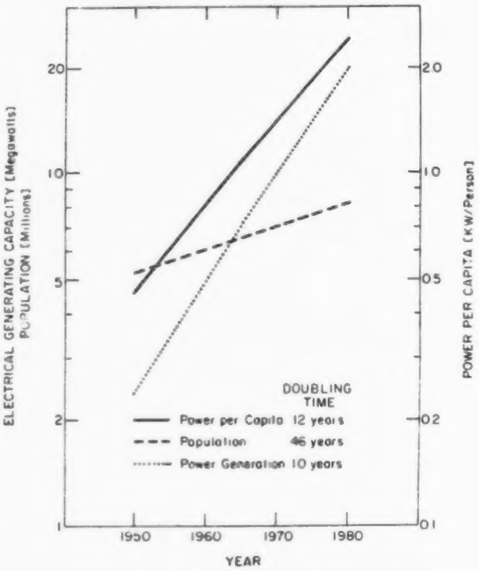
The public has actively shown its concern about the ten nuclear generating plants planned along Lake Michigan by 1973. These plants are in seven locations, three being double plants. None is designed to reduce the temperature of cooling water before it is discharged into the lake.

The proposed Commonwealth Edison plant at Zion, Illinois, has stirred such critics as Senator Gaylord Nelson of Wisconsin and Chicago Alderman Leon Despres. Mr. Despres says the company should build cooling towers to reduce the temperature of the hot water before it is returned to Lake Michigan. Some biologists and ecologists say the hot water discharges will change the temperature of Lake Michigan and alter the lake environment of native marine life.

INDUSTRY'S ANSWER

Robert A. Hirshfield, engineering consultant for Commonwealth Edison, has said "many of the critics are misinformed or jumping to conclusions." He said the Zion nuclear power plant is designed to return cooling water to the lake eighteen or nineteen degrees hotter than when it came in. A 10-year study by Edison of offshore lake water temperature showed a maximum temperature of sixty-five degrees. A nineteen degree increase in the warmest water known to Edison would result in cooling water that would be eighty-four degrees, said Hirshfield, thus meeting federal and state water pollution standards (of eighty-five degrees for discharged cooling waters).

Power generation, population, and power per capita in Chicago area, 1950-1980[7]



REDUCING THERMAL POLLUTION OF NATURAL WATERS

The alternatives developed thus far for reducing thermal effect on lake water quality are the use of cooling towers or of artificial lakes and reservoirs. There are two types of cooling towers.

Wet tower. Heat is removed by evaporation, cooling the water by twenty degrees. The main disadvantage in the wet tower is that large amounts of water are discharged into the atmosphere. For example, the towers for a 1,000 megawatt power plant would eject some 20,000 to 25,000 gallons of evaporated water per minute.

Dry tower. The heat is transferred from the cooling water, through a heat exchanger, directly to the air without evaporation. The dry system costs two and a half times as much to build as the wet system.

What Industry Says About Cooling Towers

Mr. Hirshfield, Commonwealth Edison's engineering consultant, is opposed to the use of cooling towers at Zion, Illinois. He says cooling towers for a plant the size of Zion would increase the present cost of the project by $15 to

$22 million. They would stand as high as thirty stories and would reduce the temperature of used cooling water within six to twelve degrees of that when it entered the plant, depending on humidity.

"They are unsightly, they throw off huge amounts of mist, and they could fog up the whole town of Zion," said Hirshfield. "Cooling towers," he said, "can create fog for a distance of 3/4 of a mile."

Consumers Power Company is planning to use a reservoir rather than cooling towers at their Midland, Michigan, project. "If we had planned to use cooling towers at Midland, we would be faced with an investment of $25 million. The artificial reservoir is estimated to cost $6 million less," said Harry R. Wall, senior vice president of Consumers Power Company, at the 1969 Governor's Conference on Thermal Pollution in Traverse City, Michigan.

What Government Says About Cooling Towers[8]

Primary concern is with potential fogging conditions caused by cooling towers, but other possible adverse side effects are being considered.

Because of the large amount of water vapor expelled from evaporative towers, extreme climatic conditions may cause condensation, resulting in ground level fog or drizzle. However, such conditions are not often encountered. A recent investigation of fogging problems from natural and mechanical draft towers presently operating in the eastern United States supports this conclusion. Reports indicate that natural draft towers did not produce ground level fog or drizzle under any weather conditions. Plumes rarely dropped below the top of the tower for an extended distance, and generally dissipated within a few hundred feet of a tower. Mechanical, induced draft towers reportedly produced substantial amounts of ground level fog, especially during the winter. The area affected by the fog was very small, however, extending a maximum of about one-fourth mile from the towers. Carry-over of some water droplets was also noted from the mechanical draft type. Resulting precipitation occurred in the immediate vicinity of the towers, causing some minor icing problems up to 300 feet away.

In general, undesirable meteorologic effects from towers can be prevented or controlled to a large degree through modern design that incorporates effective drift eliminators, air-flow control, etc. In situations where problems arise, the area affected is limited to that immediate to the tower installation.

What the Public Says About Cooling Towers

Proponents of cooling towers say that the $15 to $22 million quoted as the cost of cooling towers for Zion's nuclear power plant is only 10 percent of the capital cost (adding perhaps 2 or 3 percent to the electric bill).

UTILIZING THE THERMAL EFFLUENT

Waste heat may be used to prevent frost damage to orchards, or to extend the growing season of crops that bring premium prices in an early market. Cooling ponds can do double duty as recreational lakes. Thermal effluent might be used in desalination plants to aid in the evaporation process, or to improve efficiency of sewage treatment.

Others suggest using the effluent for sea-farming with selected fish tolerant of warm water, for heating buildings, or for growing plants in water in a controlled way.

ACTION TO MINIMIZE OR PREVENT THERMAL POLLUTION

The Federal Water Pollution Control Administration of the Department of the Interior established a provisional set of guidelines for water quality in 1967 that includes thermal pollution. Maximum permissible water temperatures for individual species of fish are specified and units for the heating of natural waters for industrial cooling purposes are recommended.

Senator Edward M. Kennedy has proposed that further licensing of nuclear power plant construction be suspended until a thorough study of potential hazards has been made. Senator Edmund Muskie's subcommittee on air and water pollution held hearings on thermal pollution in 1969 in many parts of the country.

Thermal pollution control measures are costly and complicated. An estimate by the FWPCA places the cost of cooling facilities needed through 1972 at $1.82 billion.

Other action suggested includes:

1) Set specific peak temperatures for each locality to prevent fish kills from temperature fluctuations. These criteria, however, might not assure the maintenance of stable ecosystems in all their complexity.
2) Undertake studies of aquatic ecology. These studies might be financed by federal, state or private agencies.
3) Require the power company to prove that its use of the stream or lake would not impair other beneficial uses.
4) Monitor both existing plants and new ones as they go into operation to insure that preliminary estimates were correct and that operating methods are sound.

LAKE MICHIGAN'S THERMAL WATER QUALITY STANDARDS

Of the four states bordering Lake Michigan, Illinois and Indiana have temperature standards, approved by the Secretary of the Interior, that require the maximum temperature of Lake Michigan water not exceed 85°F after reasonable allowance for mixing. The Wisconsin standard, also approved by the Secretary, allows up to 89°F, after mixing, at the shoreline and in harbor waters. Some, but not all, of these standards also include various provisions limiting rates of temperature increase and increases over natural temperature. The Michigan standard, which has not been approved by the Secretary, establishes no numerical limits, but is a general statement designed to abate or prevent injury of any kind, due to temperature, to any type of water use or value.

The Federal Water Pollution Control Administration is in the process of formulating new water quality standards pertaining to thermal additions to Lake Michigan. Within the next few months the four Lake Michigan states and the Federal Water Pollution Control Administration plan to consider the adoption of uniform standards to control thermal pollution in the lake.

All four states grant approval for the nuclear power plants with the understanding that requirements may be revised if experience proves such a need.

THE REAL CHOICE: THERMAL POLLUTION OR A SHORTAGE OF ELECTRIC POWER?

The ultimate decision to be made seems to be just how much money and effort the public is willing to invest in cutting down heat pollution *now* in order to avoid future problems. It must be recognized, too, that even if the choice is made to invest to prevent heat pollution of the water, the waste heat from the power generation is released into the air. Some scientists are concerned about the heat balance of the earth and the effects of the increasing releases of heat and other combustion by-products on the atmosphere – ultimately on the whole ecology. There is clearly a need for much more research to determine the amount of such releases the atmosphere will absorb without permanent change. Also research is needed to increase the efficiency of power generation to prevent pollution from its by-products, and to utilize such by-products, including heat.

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MR. STEIN: Mr. Russell G. Hill, Executive Secretary of the State Soil Conservation Committee, has had to leave, and he has left his statement.

Without objection, I would like to include it in the record at this point as if read.

STATEMENT OF RUSSELL G. HILL, EXECUTIVE SECRETARY, STATE SOIL CONSERVATION COMMITTEE, LANSING, MICHIGAN

MR. HILL: The Michigan Department of Agriculture has a concerned interest in pollution problems of the Great Lakes. Michigan, with the exception of about 1,500 acres in its southwestern corner, drains into the Great Lakes. Approximately 16 of our 37 million acres are used for agricultural purposes. The Department has several programs directly related to the management of this land and its surface water. Runoff water due to its dissolvin and erosive powers carries a variety of substances which may be classified as pollutants. Likewise, mineral and organic particulates blown by wind are transported many miles. These particles and the material they carry may also contribute to Great Lakes pollution. It is known that wind and water erosion, fertilizers, pesticides, farm animal wastes and crop residues may if improperly used and managed constitute a part of the pollution problems. The volume of several of these pollutants has already been documented to your group by the U. S. Soil Conservation Service and other agencies.

Their report shows that major Michigan streams annually contribute 1 million tons of sediment to the Great Lakes. It has also been strongly pointed out in other reports that farmland is not the only source of these pollutants. The contribution of runoff and sedimentation from subdivisions, home gardens, lawns, highways, streambanks, industrial developments, utilities, and shopping centers is beginning to be officially recognized.

The Michigan Department of Agriculture has responsibility for several programs which have direct relationship to reducing pollution in the Great Lakes.

First let us look at insecticides. All insecticides in interstate commerce are registered by the U. S. Department of Agriculture and applications for registrations are routinely reviewed at the Federal level by the Public Health Service, the Food and Drug Administration, the Fish and Wildlife Service of the Department of the Interior as well as the U. S. Department of Agriculture.

Under Michigan law, the Michigan Department of

Agriculture may take further action to restrict registration of a pesticide upon recommendation of Michigan State University Experiment Station. This latter provision in our law is a key to our regulatory action which we took against DDT in 1969. This action concerning DDT in Michigan was not a ban but rather an extension of previous restrictions on DDT registrations. Michigan canceled registrations for mosquito control in 1968. Michigan was one of the first States in the Nation to take this positive action against the use of DDT. Our action was based upon the fact that scientists at Michigan State University, aware of the long-range implications in the use of persistent pesticides, have been working for years to phase these materials out of our recommendations as suitable alternative materials are developed.

Also in 1969 under the leadership of the State Agriculture Department, an inter-agency pesticide review committee was established. Agencies participating in the agreement with the Department of Agriculture are the Departments of Natural Resources, Public Health, and the Water Resources Commission. More than 5,000 economic poison registrations have been reviewed by the Department of Agriculture laboratory since establishment of the cooperative agreement. Nearly 700 requests for review of labels have been received from participating agencies. The Michigan Department of Public Health was recently asked to review all labels and more than 600 have since been referred. Of about 70 objections to registration, 38 have been satisfactorily resolved and 32 are being studied. It should be noted that Michigan farmers have replaced most uses of persistent pesticides as agricultural research has provided alternative insect and disease controls. A recent survey of 5,100 farmers revealed that less than one in a thousand reported any use of DDT last year. Use of other persistent materials was very limited, mainly to control certain corn and livestock pests.

Mr. B. Dale Ball, Director of the Michigan Department of Agriculture, stated that similar surveys of agricultural use of pesticides were also conducted in the other four Great Lakes States -- Indiana, Illinois, Wisconsin, and Minnesota -- as part of the five-State Governors Conference on Lake Michigan.

A second program area within the Department involves soil and water conservation. The State Soil Conservation Committee is a division of the Department and has charge of the organization and supervision of Michigan's Soil Conservation District. The first district was established in Michigan in 1938. Since that period, every county but one has organized similar districts.

One of the primary objectives of these organizations is the reduction of erosion by wind and water. These districts have been active in controlling erosion for over 30 years and have established an enviable record. The 84 districts in Michigan's 82 counties have about 58,000 landowners as cooperators. In recent years, assistance has been extended not only to farmers but also to a great variety of non-farm land users. A major development has been the effort by soil conservation districts to have local units of government adopt erosion control regulations which would reduce sedimentation by many development activities. Several municipalities have already adopted such regulations and it is expected to spread.

There may also be a move for Statewide legislation which would require land developers of all kinds to install proper soil and water control measures as recommended by their local soil conservation districts.

Data submitted by the U. S. Soil Conservation through its "Inventory of Soil and Water Conservation Needs" show that our job is far from completed. Their data points out that large quantities of soil still reach the Great Lakes through our major river basins and that about two-thirds of our cropland must have soil and water conservation treatment either initially or recurring. Nearly one million acres of cropland are subject to severe wind erosion. However, we have the tools to do the job and the organization established.

The State Soil Conservation Committee likewise acts for the Governor's office in processing applications for watershed assistance under Public Law 566. To date, 74 communities have submitted applications for Federal watershed assistance. Forty-eight of these applications have been approved by the State Committee; four have been disapproved; and twenty-two are before the Committee for consideration. Six watersheds have been completed and the U. S. Soil Conservation Service informs us that 10 additional projects are now in operation.

In order to accelerate the watershed planning on the approved applications, the Michigan Legislature in 1970 provided funds for the State Soil Conservation Committee of the Michigan Department of Agriculture to employ a supplemental watershed planning party. This move should help accelerate the rate at which local communities are serviced for watershed assistance.

Inasmuch as land treatment is a basic objective of these watershed projects, the furtherance of this program should materially assist in reducing sedimentation pollution which would eventually reach the Great Lakes. Here, too, it should be pointed out that we still have a long way to go. Approximately 140 watersheds have been identified as having potential need for Public Law 566 assistance. Many years of effort must be expended before this volume of work can be accomplished.

Related to the soil and water conservation program is the use of commercial fertilizers which may pollute water. Reference is especially made to nitrogen and phosphorus. Educational programs now being conducted by soil conservation districts and the Cooperative Extension Service encourage soil testing as a guide for the proper application of commercial fertilizer. Research carried out in this State and in other States show that very little phosphorus reaches our water areas by underground sources. Excessive uses of nitrogen may provide some basis of contamination. Here too it is becoming more evident that the loss of these plant food minerals is probably due more to erosion than infiltration into underground water. Our efforts to control erosion, therefore, should also help alleviate the loss of plant nutrients from land and the subsequent contamination of water areas.

Another related area is the farm animal solid waste disposal problem involving large concentrations of farm animals. The severity of this problem has also been documented for your use by other agencies. Soil Conservation Districts are closely working with the Agricultural Stabilization and Conservation Service and the U. S. Soil Conservation Service, and the Cooperative Extension in developing and encouraging methods of properly handling farm manures.

Nearly 100 requests from landowners with farm animal waste problems have been submitted to ASCS for cost-sharing and the SCS reports servicing about 50 of these requests.

Pollution from this source can be severe under a variety of conditions, but through installation of proper surface runoff control structures and solid waste disposal units we are confident that this problem too can be brought under control. Pollution control regulatory authority in the hands of the State Water Resources Commission will also help bring about compliance of livestock waste disposal so that pollution from these installations will be minimal.

Still another area in which the Department has a responsibility which relates to the Great Lakes pollution problem is inter-county drains. An administrative staff member of the Department serves as chairman of all inter-county drainage boards. It is recognized that properly constructed drains reduces excessive erosion and subsequent sedimentation of water. Educational and information efforts are being extended to encourage the proper engineering of drainage projects so that ditch banks may be properly seeded and stabilized and spoil banks treated so that erosion will not occur and life of the drainage structure extended.

These are some of the major areas in which the Michigan Department of Agriculture are involved which directly relate to the pollution problem of the Great Lakes. We do not say that all problems are adequately under control or that pollution from these sources has been entirely stopped. We are saying that we are confident that the sources of agricultural pollution have been and are being reduced and that further reduction will continually occur. New research in some areas such as farm waste control, pesticides, commercial fertilizer management, and erosion control on non-farm areas are needed so that the proper control techniques may be practically applied. Certain regulatory legislation may be necessary to force compliance in some areas.

Nearly 50,000 acres of agriculture land are being transferred to non-agricultural use each year. There is little evidence that this transfer is being accomplished with careful planning or in line with any long-time land use policy. The time is past due for the State in consultation with its citizens to develop a meaningful land use policy. The Department of Agriculture is giving leadership in obtaining action in developing such a policy. A widespread information and education program is essential in order to provide people with an understanding of their involvement in Great Lakes pollution problems, the corrective steps that must be taken, and assistance that is available to correct these problems. We pledge our continual effort toward these accomplishments.

MR. STEIN: John F. Wilson.

STATEMENT OF JOHN F. WILSON, DIRECTOR, WISCONSIN ECOLOGICAL SOCIETY, GREEN BAY, WISCONSIN

MR. WILSON: My name is John F. Wilson, and my address is Green Bay, Wisconsin. I am a Director of the Wisconsin Ecological Society, and this paper represents the views of the organization and its individual members.

I would like to comment, before I present the paper that I intend to present, on some of the views and thoughts expressed in the press this week by various scientists and engineers that are tantamount to creating in Lake Michigan a large, experimental tank. And I am appalled, quite frankly, at these suggestions made by ostensibly responsible people.

I would like to also ask the conferees to seriously consider Dr. Bardach's suggestion about making the industrial users of our environment require -- or require them to set up an environmental insurance program. I don't know exactly who might underwrite these activities, but I really feel that this is something we should seriously consider.

I would like to present some material here that was developed in 1969 on the Fox River and in lower Green Bay by Professors R. P. Howmiller and A. M. Beeton.

I am very quickly just going to summarize a few of the highlights of this report and then I am going to make some comments on it.

This was a study made on lower Green Bay using the identical parameters and the exact sampling stations and at the same time of the year that studies were made in 1952 by some other University of Wisconsin professors.

Now, this is an unpublished manuscript; it will be published. Basically, what it says is that Green Bay is a relatively shallow, fertile arm of Lake Michigan, and it describes the bay and its physical condition.

Pollution of Green Bay and concomitant concern have increased in recent years. The major tributary of the Bay, the Fox River, contributes an average of 125 milliliters per 3 seconds of grossly polluted water; D.O. content of the river water approaches zero, and it goes into a fairly -- by this time -- well known expose of the conditions on the Fox River and in lower Green Bay.

He discusses in this paper some of the findings in 1952. He concludes the paper by saying -- well, I will read two paragraphs:

"Carr and Hiltunen (1965) documented changes in the benthos of western Lake Erie from 1930 to 1961. Some of the changes observed were similar to those occurring in Green Bay. Oligochaeta" -- sludgeworms -- "and Chironomidae (Tendipedidae)" -- bloodworms -- "increased in abundance while Hesagenia decreased to less than 1 percent of its former abundance. It appears that Hexagenia completely disappeared from the area in the years 1961-1967 ....

"Other changes recorded for western Lake Erie as a whole are unlike changes observed in Green Bay.

Gastropoda and Sphaerlidae increased substantially from 1930 to 1961 .... However, in 1961, these groups and leeches and naiad clams were rare near the major sources of pollution; the mouths of the Maumee and Raisin Rivers and the western side of the Detroit River mouth. It appears that lower and middle Green Bay are ecologically similar to highly polluted areas of western Lake Erie but they are more degraded than open lake areas of Erie were in 1961.

"The future of the Green Bay bottom fauna is not difficult to predict if pollution of the bay, via the Fox River, continues. We can then expect a large abiotic area around the river mouth. Also, midge larvae would be expected to decrease in abundance at stations farther north in the lower bay. Other groups would, of course, continue their demise."

And this is basically the conclusion. There are some other details of it, but I am submitting the entire report to this conference together with the various charts that clearly document the condition of the Bay not in 1967 or 1965 but in 1969.

(The documents above referred to follow in their entirety.)

SOME CHANGES IN THE BOTTOM FAUNA OF GREEN BAY,[1] LAKE MICHIGAN FROM 1952 TO 1969

R. P. Howmiller and A. M. Beeton

Running head: Changes in Green Bay Benthos

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[1] Contribution No. 39, Center for Great Lakes Studies, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201

ABSTRACT

Bottom samples were collected in lower and middle Green Bay in May 1969 on the same date, at the same 27 stations, and using the same methods as a 1952 survey.

In 1969 there were fewer Oligochaeta and Chironomidae in the vicinity of the Fox River mouth. Elsewhere in the lower and middle bay oligochaetes and midge larvae were more abundant than in 1952 but most other benthic invertebrates were less abundant.

The observed changes are interpreted as indicative of greater pollution and increased eutrophication during the intervening 17 years.

INTRODUCTION

Green Bay is a relatively shallow and fertile arm of Lake Michigan (Fig. 1). The bay has long been important for recreational uses, shipping and commercial fishing. As early as the 1880's, undesirable changes in the bay were recognized. Smiley (1882) reported that sawdust pollution was an important factor in the decline of the whitefish population in the 1870's.

Pollution in Green Bay, and concomitant concern, have increased in recent years. The major tributary of the bay, the Fox River, contributes an average of 125 m^3/sec of grossly polluted water. The dissolved oxygen content of the river water approaches zero mg/liter in summer months (Schraufnagel, et al., 1968). Even "pollution tolerant" benthic invertebrates are rarely found in the sediments of the lower reaches (Balch, et al., 1956; Schraufnagel, et al., 1968).

Water from the Fox River spreads out over the lower 15-20 km of the lower bay (Schraufnagel, 1966) and dominates the character of this environment. The middle bay, from the Green Bay harbor entrance light north to Sturgeon Bay, is affected by Fox River water mainly in the eastern half where river water may account for as much as 80% of the northward current (Modlin and Beeton, 1970). In this region the major influence of the polluted water appears during the months of ice cover (WSCWP, 1939; Schraufnagel, et al., 1968, Howmiller and Beeton, 1970) when large areas suffer oxygen deficiency.

Various public agencies have conducted chemical and biological surveys on the bay to assess the severity and extent of pollution (WSCWP, 1939; Surber and Cooley, 1952; Balch, et al., 1956; Schraufnagel, et al., 1968). Bottom sampling, for analysis of benthic invertebrate animals, was a part of each of these studies. Surber and Cooley (1952) compared numbers of organisms at nine of their stations in the lower bay in May 1952 with data from nine comparably located stations sampled during the period November 1938 to February 1939. The increased number of pollution tolerant midges and oligochaetes led them to conclude that there was an increase in pollution during the intervening thirteen years.

A later report was less pessimistic. None of the samples taken in 1955 (January) contained populations of sludge worms (Oligochaeta) in the numbers indicated in either the 1938-39 or the 1952 studies (Balch, et al., 1956). Discounting the possibility that January samples were not taken at a population peak, the report concludes that "most probably, there is a major reduction in the numbers of these forms (Oligochaeta)." It is not clear why the possibility of a winter minimum of population density was treated so lightly. Great reductions in numbers of oligochaetes may occur during winter months (Howmiller and Beeton, 1970).

Howmiller and Beeton (1967) compared numbers of oligochaetes, midge larvae, and burrowing mayflies taken at stations in the lower bay in 1938 and 1966. In 1966, fewer oligochaetes and midges were found in the immediate vicinity of the river mouth but they were more abundant in the region 5-15 km from the river mouth (Beeton 1969). Nymphs of the burrowing mayfly, Hexagenia, taken at two of eight stations in 1938, were not found in 1966. Changes were interpreted as indicative of increased pollution near the Fox River mouth and increased eutrophication of the bay.

Critical comparison of data from these past studies may be open to question because investigators seldom visited the same stations sampled in preceeding studies. They also generally failed to sample at the same season of the year. Thus year to year changes in animal numbers may be confused with normal seasonal variation in abundance. Furthermore, these investigators did not always use the same apparatus and methodology as their predecessors.

The present report discusses a study of changes in the benthic fauna of Green Bay which has attempted to eliminate these three sources of inaccuracy.

METHODS

On 26 May 1969 we sampled the benthos of lower and middle Green Bay at the stations shown in Figure 1. Samples were taken with a 23x23 cm (9x9 in) Ekman grab and screened immediately with a U.S. Std. No. 30 sieve. The residue on the sieve was preserved in 10%

formalin. Organisms were hand picked from the residue using low power magnification.

A Ponar grab sample was also taken at each station. These samples were processed in the same manner as the Ekman grab samples. The Ponar grab samples were taken primarily for purposes not concerned with the subject of this paper, and data from Ponar grab samples are not compared directly with 1952 data but are simply mentioned in Table 2 to indicate that certain animal taxa did occur at stations where they were not taken in Ekman grabs.

These same stations were sampled on 26 May and 27 May 1952, exactly seventeen years earlier, by Surber and Cooley (1952). They used, with one exception, a 15x15 cm (6x6 in) Ekman grab and processed samples with a No. 30 screen. The single exception is that a Petersen grab was used to take their sample at station 11 which was on a hard sand bottom.

RESULTS AND DISCUSSION

Aquatic oligochaete worms are commonly known as "sludge worms" and large numbers of these animals frequently have been cited as evidence of pollution. In general Oligochaeta have increased in abundance from 1952 to 1969 (Tables 1, 2; Fig. 2).

The only notable exception to this generalization is in the immediate vicinity of the river mouth (Stations 1-4). This cannot be interpreted as a result of improved environmental conditions for there is a similar dearth of other benthic life in this area.

Long periods of anoxia during summer months (Schraufnagel, et al., 1968) probably make it impossible for healthy populations of any animals to exist in the vicinity of the river mouth.

Surber (1957), after studying reports from a number of lakes, concluded that, ". . . an abundance of tubificids in excess of 100 per square foot apparently truly represented polluted habitats." Wright (1955) and Carr and Hiltunen (1965) used the following numbers of oligochaetes per square meter to designate pollution areas in western Lake Erie: light pollution, 100-999; moderate pollution, 1000-5000; and heavy pollution, more than 5000. Lower Green Bay is, by these standards, heavily polluted (Table 2, Fig. 2).

The middle bay (stations 11-27), according to Wright's standards, was only "lightly polluted" in 1952 (Table 1) but was at least "moderately polluted" in 1969.

Goodnight and Whitley(1960), working on a midwestern stream, proposed that the relative abundance of oligochaete worms in the benthos should be used as an index of pollution. They considered the stream in "good condition" if the bottom fauna were less than 60% Oligochaeta, "doubtful" if 60-80% and highly polluted if more than 80% oligochaetes. In 1952 Oligochaeta accounted for an average of 66% of the benthic organisms in samples from stations 2-10 in the lower bay. In 1969 the average percentage of oligochaetes in these samples was 85. Thus it appears that this area has deteriorated from some doubtful condition to a highly polluted state in the intervening seventeen years (Fig. 3).

An increased relative abundance of Oligochaeta is more pronounced in the middle bay. At stations 11-27, Oligochaeta have increased from an average of 23% to 64% of the total benthic fauna in the years 1952-1969. Thus, by the standards of Goodnight and Whitley, it has gone from a "good condition" to "doubtful" since 1952 (Fig. 3).

Surber and Cooley (1952) believed that, at the time of their collections, the majority of the Oligochaete fauna belonged to the tubificid genus Limnodrilus. They stated that a few Tubifex also occurred in the samples. They recorded the naidid genera Dero and Stylaria at, respectively, stations 25 and 26, and stations 12 and 26. The oligochaete fauna of Green Bay is now known to consist of one species of Lumbriculidae, ~~nine~~ ten Naididae, and 19 Tubificidae (Howmiller and Beeton, 1970).

Leeches (Hirudinea) were much less abundant and not as widespread in their distribution in 1969 as in 1952 (Fig. 4). This is probably a function of increased pollution since, as a group, leeches do not appear to be able to tolerate decomposition gases at low oxygen concentrations (Pennak,1953). Carr and Hiltunen (1965) concluded that, in western Lake Erie, leeches were adversely affected by polluted conditions near river mouths. The leeches collected in 1952 were identified as Glossiphonia nephreloidea, which occurred predominantly in the lower bay, and Helobdella (Glossiphonia) stagnalis in the middle bay. The 1969 collections included Erpobdella punctata, Helobdella stagnalis, and a fish leech (Piscicolidae), Illinobdella, which was represented by the five specimens in the Ponar grab sample at Station 3. The fish leeches appeared very emaciated. The Glossiphoniidae, Glossiphonia and Helobdella, commonly are predacious upon snails, oligochaetes, and other small invertebrates (Pennak, 1953). Erpobdella punctata, now the most common leech in the bay, apparently feeds heavily upon oligochaetes. Two of fifteen specimens examined had oligochaete worms in their mouths at the time of capture. The decline of leeches in Green Bay may have contributed to the greater success of the Oligochaeta.

Snails occurred at ten stations of the 1952 survey but at only two stations in 1969 (Fig. 5). Collections in 1952 included Campeloma, Helisoma, Valvata tricarinata, and Viviparus. Empty shells of these taxa now occur at many stations in the lower and middle bay but the only one of the four found living in our recent Green Bay collections is Viviparus. Viviparus did not, however, occur in 1969 sampling at stations being compared in this report. The snails found at stations 13 and 15 belong to the genus Amnicola.

Fingernail clams (Pelecypoda, Sphaeriidae), like snails, were much less abundant in 1969 than in 1952 (Fig. 6). They decreased from an average of 16.5% of the total benthic fauna to 3.3%. The species of Sphaeriidae inhabiting Green Bay have not yet been determined. As a group, the fingernail clams are known to be less pollution tolerant than most Oligochaeta and many species of Chironomidae (Keup, Ingram and Mackenthun, 1966).

While no naiad clams (Unionidae) were reported in 1952, *Lampsilis siliquoidea* was found at station 15 in 1969. This species has recently been found at several other stations on the sandy substrates just north of Long Tail Point but not elsewhere in the lower or middle bay. The presence of naiads generally indicates clean water (Carr and Hiltunen, 1965). In Green Bay it is probably also closely related to the nature of the substrate. Soft muds, common over much of the bay, are not a suitable substrate for these large clams.

While the distribution of amphipods (Fig. 7) was very similar in 1952 and 1969, this group seems to have been much more abundant and to have comprised a larger proportion of the population in the 1952 collections. Surber and Cooley (1952) reported only *Gammarus fasciatus* from their collections. In 1969, *Hyalella azteca* occurred at stations 7, 15, 25, and 27; *Gammarus fasciatus* and *Pontoporeia affinis* at stations 11, 24 and 25; and *Crangonyx* at station 27.

The isopod, *Asellus*, occurred at too few stations to allow generalizations concerning possible changes in abundance or distribution. Widespread sampling in the years 1966-1969 indicates that *Asellus* occurs farther south in the bay than the data in Table 3 suggest. Cooley and Surber (1952) identified the isopod present at that time as *A. communis*. Balch and co-workers (1956) recorded *A. militaris*. The isopod present in 1969 was *A. militaris*.

The burrowing mayfly (*Hexagenia*) was once quite abundant in Green Bay. In years past, adult *Hexagenia* piled up by the bushel under electric lights in the city of Green Bay on many summer evenings (WSCWP, 1939). The report of 1939 (WSCWP) registered surprise at the small numbers recovered but recorded *Hexagenia* nymphs in 16 of 51 samples. At that time it occurred as far south as the vicinity of Long Tail Point. Surber and Cooley (1952) found *Hexagenia* only at station 16. In 1955 one burrowing mayfly "was [illegible]d" at a station near the mouth of the Oconto River (Balch, et al, 1956). *Hexagenia* was not recorded in the data of the report. *Hexagenia* did not occur in samples taken in 1969 or at any of 74 other widespread stations sampled by the Federal Water Pollution Control Administration in 1967 and the Center for Great Lakes Studies, University of Wisconsin-Milwaukee in the years 1966-1969 (Howmiller and Beeton, 1970). It has apparently disappeared from Green Bay as it has from western Lake Erie (Carr and Hiltunen, 1965; Veal and Osmond, 1968).

The aquatic larvae of midges (Chironomidae) were the second most abundant and widespread members of the benthic fauna in both 1952 and 1969 (Fig. 8). The midges decreased markedly in the vicinity of the Fox River mouth—doubtless because of increased pollution. Increased numbers of midges were found at most stations north of Long Tail Point. However, this increase did not equal that of the Oligochaeta with the result that midges decreased in relative importance from an average of 48 to 37% of benthic invertebrates in the middle bay and from 37 to 26% for the bay as a whole. The Chironomidae includes many species adapted to a wide range of environmental conditions. However, as a group, the midges display pollution tolerance second only to the Oligochaeta. Like many Oligochaeta, the pollution tolerant midges have an abundant supply of hemoglobin which makes them very efficient at obtaining oxygen at the low concentrations associated with organic pollution, and in the profundal region of stratified eutrophic lakes.

The only animals found at station 1 in 1969, Psychoda larvae, are air breathers which are abundant in mud flats, drains, sewage filters, and other habitats subject to total deoxygenation (Hynes 1960). Eristalis larvae, found at station 1 in 1952, are ecologically similar. Both these organisms have been reported from other rivers so grossly polluted that no normal river animals survive (Hynes, 1960). However, since they require contact with the surface to breathe, these cannot have been viable populations at depths of 18-21 ft at station 1. These animals must have been carried to station 1 by the current from shallow-water anaerobic habitats upstream.

The common and abundant benthic nematode in Green Bay in 1969 measured about 4.5-5 mm long and 0.2 mm in diameter. An animal this size certainly cannot be collected quantitatively when a No. 30 screen (0.6 mm openings) is used and, therefore, nematodes were not counted in our samples. In view of the abundance and wide-spread occurrance of nematodes in 1969 (Table 2) it is difficult to believe that they occurred at only one station in 1952 (Table 1). Perhaps samples were screened more vigorously and almost all nematodes were lost. Another possibility is that they were so abundant in 1969 that sufficient numbers were retained as to be noticed.

CONCLUSIONS

There were marked changes in the bottom fauna of lower and middle Green Bay between 1952 and 1969. Two animal groups which contain many eutrophic and pollution tolerant species, the Oligochaeta and the Chironomidae, have increased in abundance over most of the bay. Most other benthic invertebrates were less abundant in 1969 than in 1952. These changes suggest that the deterioration of the bay environment, noted by previous investigators, is continuing.

Carr and Hiltunen (1965) documented changes in the benthos of western Lake Erie from 1930 to 1961. Some of the changes observed were similar to those occurring in Green Bay. Oligochaeta and Chironomidae (Tendipedidae) increased in abundance while Hexagenia decreased to less than 1% of its former abundance. It appears that Hexagenia completely disappeared from the area in the years 1961-1967 (Veal and Osmond, 1968).

Other changes recorded for western Lake Erie as a whole are unlike changes observed in Green Bay. Gastropoda and Sphaeriidae increased substantially from 1930 to 1961 (Carr and Hiltunen, 1965). However, in 1961 these groups and leeches and naiad clams were rare near the major sources of pollution; the mouths of the Maumee and Raisin Rivers and the western side of the Detroit River mouth. It appears that lower and middle Green Bay are ecologically similar to highly polluted areas of western Lake Erie but they are more degraded than open lake areas of Erie were in 1961.

The future of the Green Bay bottom fauna is not difficult to predict if pollution of the bay, via the Fox River, continues. We can then expect a larger abiotic area around the river mouth. Also, midge larvae would be expected to decrease in abundance at stations farther north in the lower bay. Other groups would, of course, continue their demise. The Oligochaeta, the only group which increased in absolute and relative abundance between 1952 and 1969, would assume even greater importance in the benthic community.

With the disappearance of other major groups further changes in the bay environment must be assessed through changes in numbers of the Oligochaeta and Chironomidae and through changes in species composition of these groups.

A report on the distribution of oligochaete species in Green Bay is in preparation (Howmiller and Beeton, 1970). A study on the distribution of species of Chironomidae, a taxonomically difficult group, is planned for the near future.

ACKNOWLEDGEMENTS

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Mr. Ratko Ristic drew the figures.

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Table 1. Abundance of benthic invertebrates, as individuals per square meter, in samples taken at stations shown in Fig. 1 on 26 and 27 May 1952.

Station	Nematoda	Oligochaeta	Leeches	Snails	Clams	Amphipods	Isopods	Midges	Other
1	0	43	0	0	0	0	0	129	43 *Eristalis*
2	0	113152	86	0	258	0	0	1377	
3	0	33829	0	0	0	0	0	3099	
4	0	51175	43	0	0	0	0	1636	
5	0	13472	43	0	0	0	43	1679	
6	0	9813	86	172	344	0	0	1765	
7	0	2109	215	258	732	0	0	1679	
8	0	1420	86	129	732	0	0	2281	
9	0	2324	86	301	2668	0	0	947	
10	0	775	258	43	516	0	0	1162	
11	0	897	0	258	75	710	11	86	11 Caddis, *Molanna*
12	0	430	43	86	516	0	0	344	
13	0	258	43	43	1592	0	0	258	
14	0	904	0	43	603	0	0	1549	
15	0	603	0	0	732	560	301	990	
16	43	1033	129	0	1420	0	0	1334	72 *Hexagenia*
17	0	86	0	0	0	0	0	301	
18	0	387	43	0	301	0	0	646	
19	0	43	344	0	43	0	0	86	
20	0	581	0	0	129	0	0	2539	
Oconto-1(21)	0	861	258	43	603	0	0	646	
Oconto-2(22)	0	818	43	0	473	0	0	745	
Oconto-3(23)	0	0	129	0	301	0	0	646	
Oconto-4(24)	0	0	129	0	0	0	0	818	
Oconto-5(25)	0	301	43	0	387	0	0	560	
Oconto-6(26)	0	387	0	0	301	0	0	1291	
Oconto-7(27)	0	516	0	0	258	43	0	2410	

Table 2. Abundance of benthic invertebrates, as individuals per square meter, in samples taken at stations shown in Fig. 1 on 28 May 1969.

Station	Nematoda	Oligochaeta	Leeches	Snails	Clams	Amphipods	Isopods	Midges	Other
1	0	0	0	0	0	0	0	0	96 *Psychoda*
2	+	22657	0	0	0	0	0	38	
3	0	8604	0**	0	0	0	0	688	
4	+	7227	0	0	0	0	0	440	
5	+	29292	0	0	0	0	0	2237	
6	+	16921	0	0	0	0	0	3155	
7	+	11854	76	0	38	0**	0	1778	
8	+	4264	0**	0	57	0	0	860	
9	+	2008	19	0	631	0	0	1759	
10	+	1032	19	0	19	0	0	76	
11	+	1663	0	0**	172	0**	0**	402	
12	+	822	0	0	994	0	0	1836	
13	+	688	0	19	268	0	0	1644	
14	+	918	0	0	19	0	0	3097	
15	+	2792	0	19	1166	19	0	554	19 *Lampsilis*
16	+	1281	0	0	0	0	0	1128	
17	+	1109	0**	0	0**	0	0	918	
18	+	229	0	0	0	0	0	707	
19	+	4531	0	0	57	0	0	2314	
20	+	2658	0	0	0	0	0	2065	
21	+	5354	0	0	0	0	0	803	
22	+	1740	0	0	0	0	0	1530	
23	+	899	0	0	0	0	0	344	
24	+	9770	19	0	0	57	76	1300	
25	+	19325	0	0	10	38	38	631	
26	+	23441	0	0	0	0	0	1166	
27	+	10095	0	0	0	19	0	2275	

*Nematoda were very numerous in many samples but certainly not sampled quantitatively, hence not counted.

**Not taken in Ekman grab sample but animals in this category were recorded from Ponar grab sample taken at the same time.

FIGURE LEGENDS

Figure 1. Lower and middle Green Bay, Lake Michigan, showing bottom sampling stations of 26 and 28 May 1952 and 26 May 1969.

Figure 2. Distribution and abundance of Oligochaeta in the sediments of lower and middle Green Bay on 26 and 28 May 1952 (left) and 26 May 1969 (right).

Figure 3. Relative abundance of Oligochaeta, as percentage of total bottom fauna, in May 1952 and 1969.

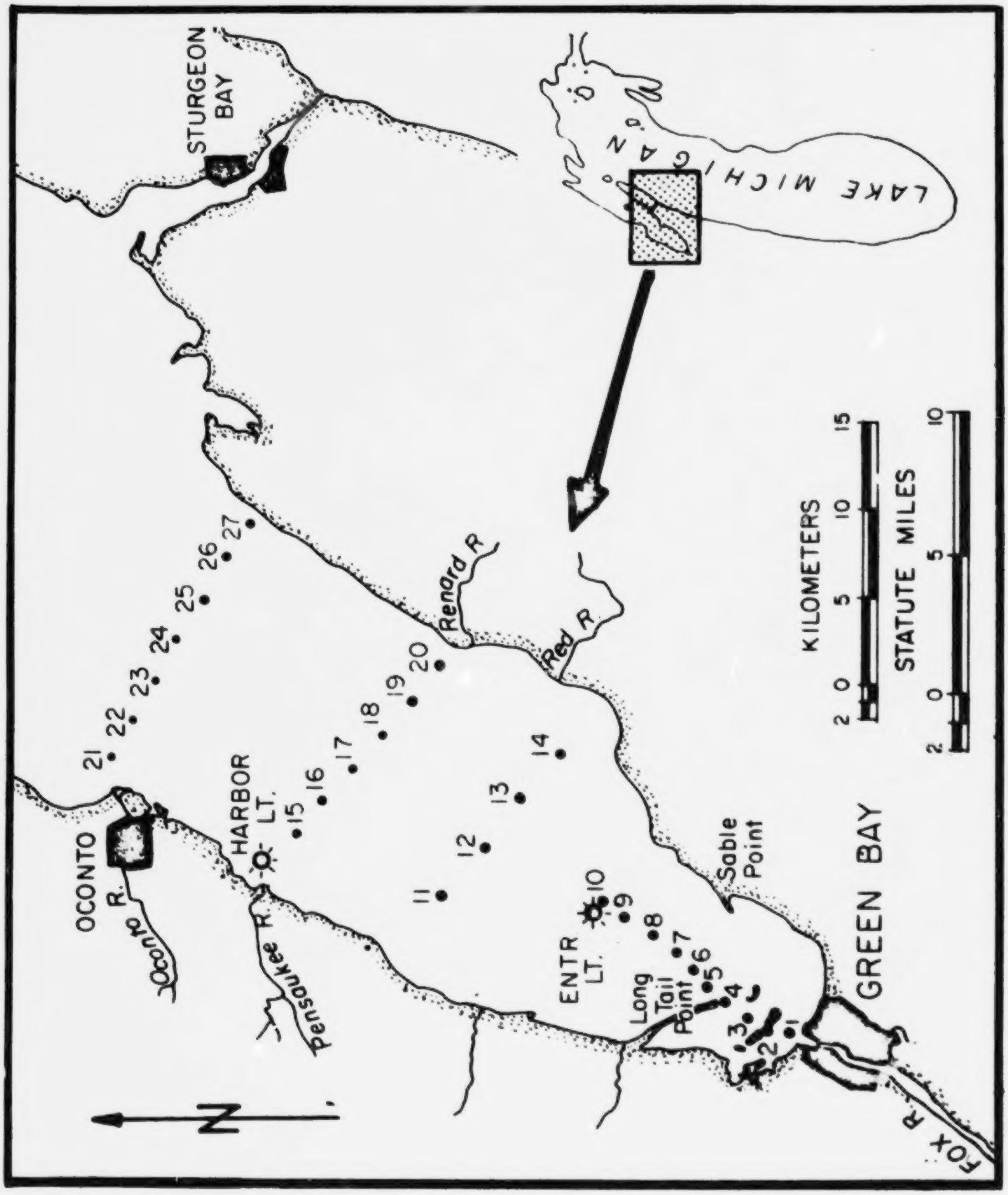
Figure 4. Distribution and abundance of leeches in lower and middle Green Bay in May 1952 and 1969.

Figure 5. Distribution and abundance of snails in May 1952 and 1969.

Figure 6. Distribution and abundance of fingernail clams in May 1952 and 1969.

Figure 7. Distribution and abundance of amphipods in May 1952 and 1969.

Figure 8. Distribution and abundance of Chironomidae in May 1952 and 1969.


N
STURGEON BAY
LAKE MICHIGAN
OCONTO
Oconto R.
HARBOR LT.
Pensaukee R.
ENTR LT.
Long Tail Point
Sable Point
GREEN BAY
FOX R.
Renard R.
Red R.
KILOMETERS
2 0 5 10 15
STATUTE MILES
2 0 5 10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
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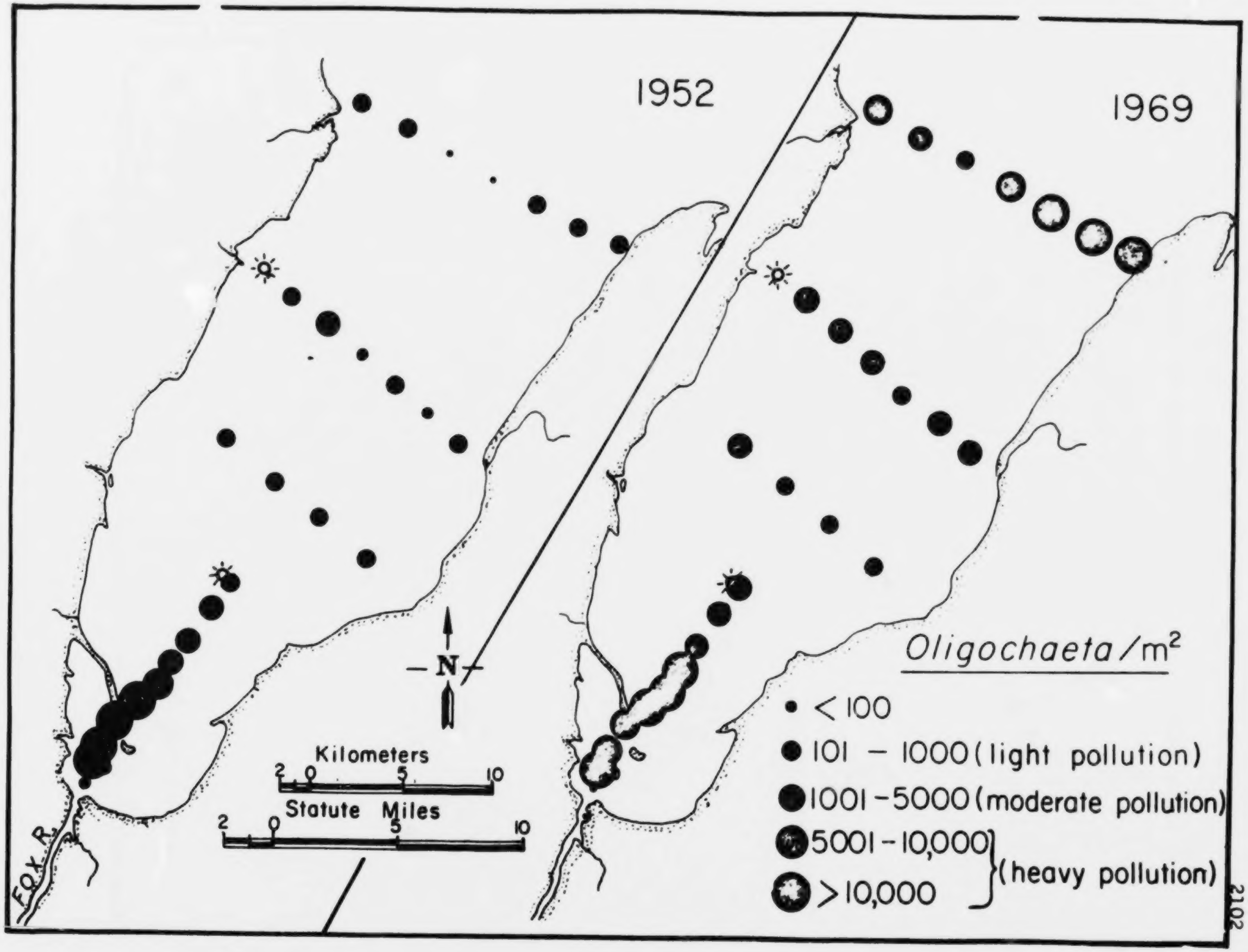
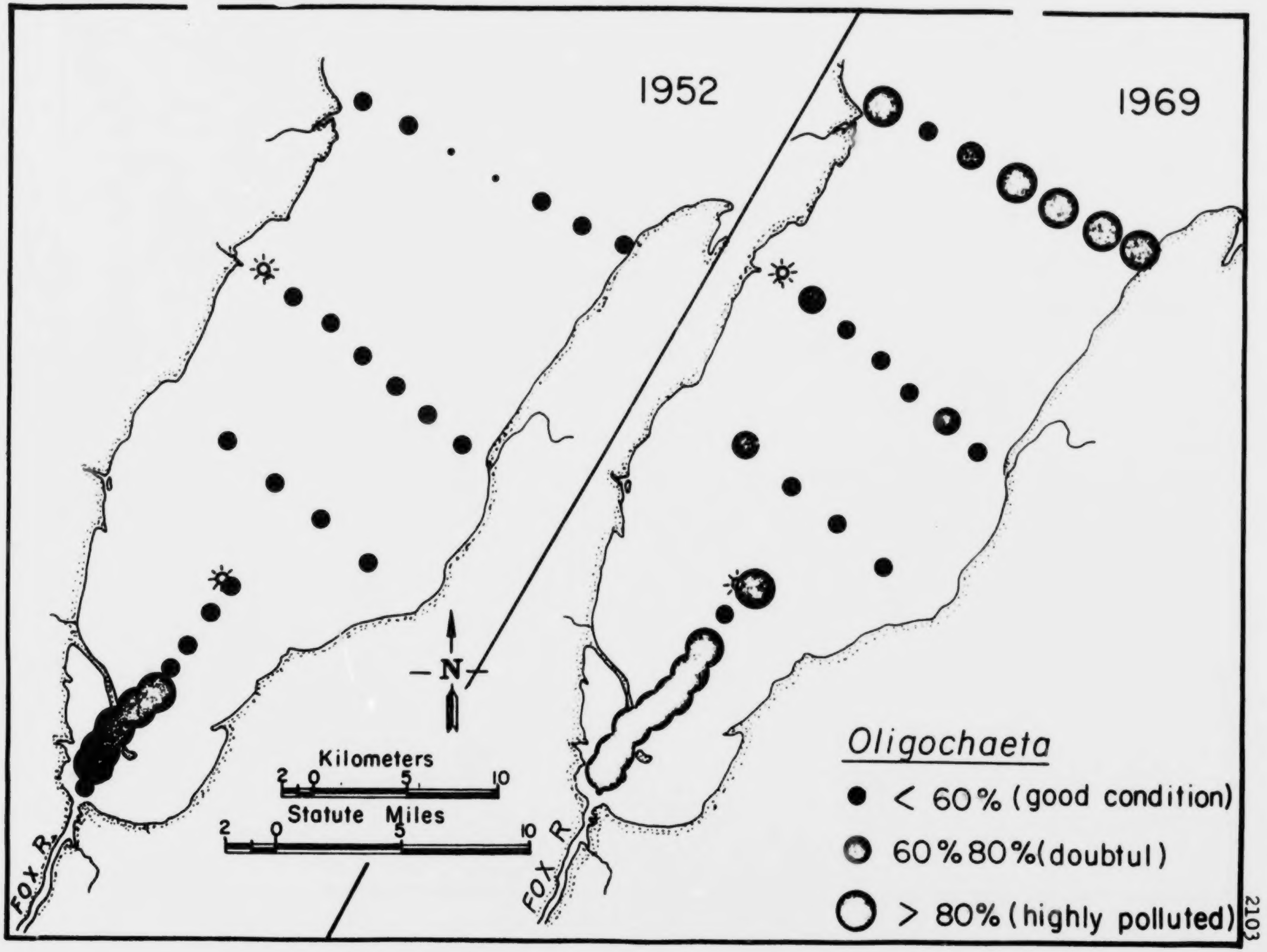
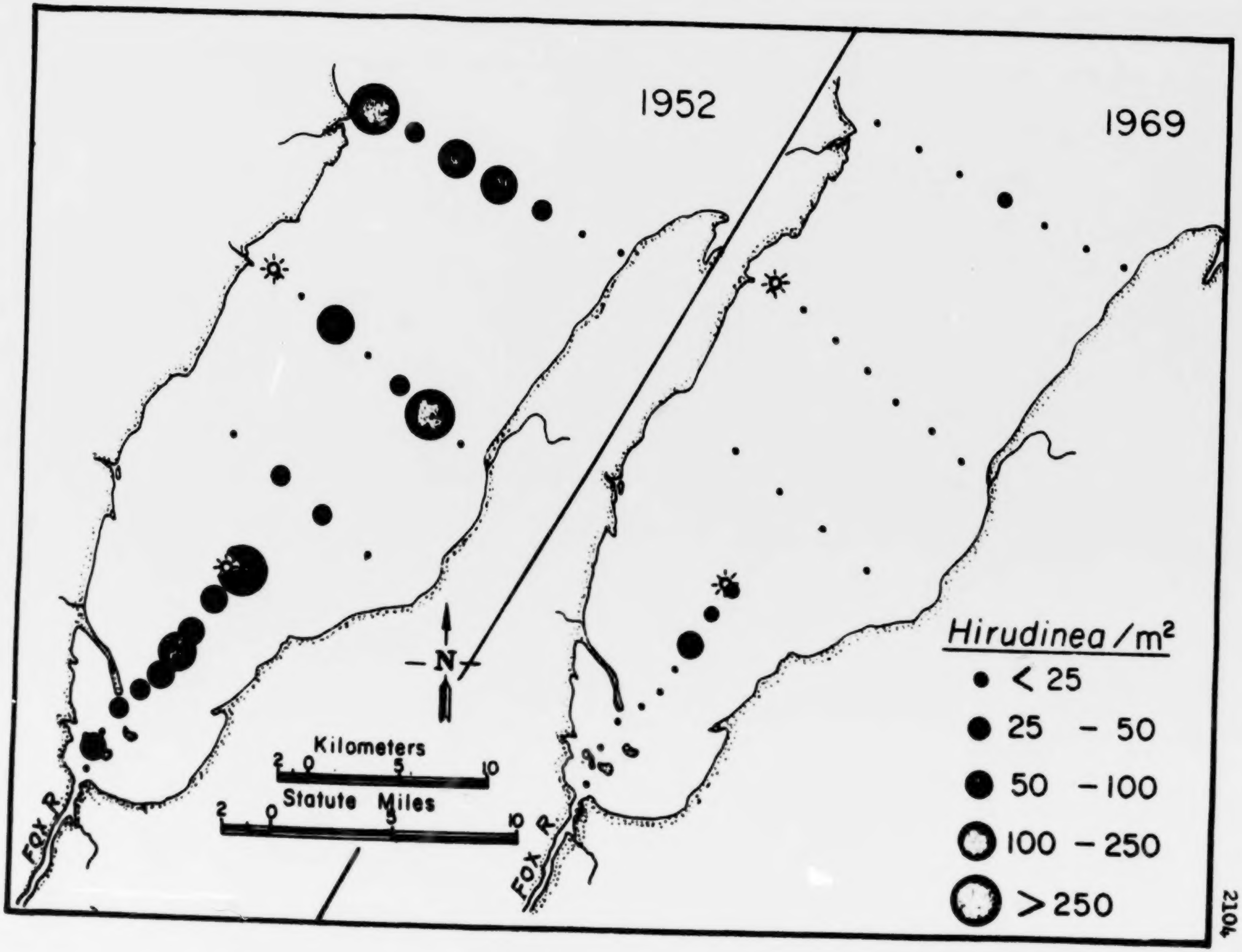
24
25
26
27

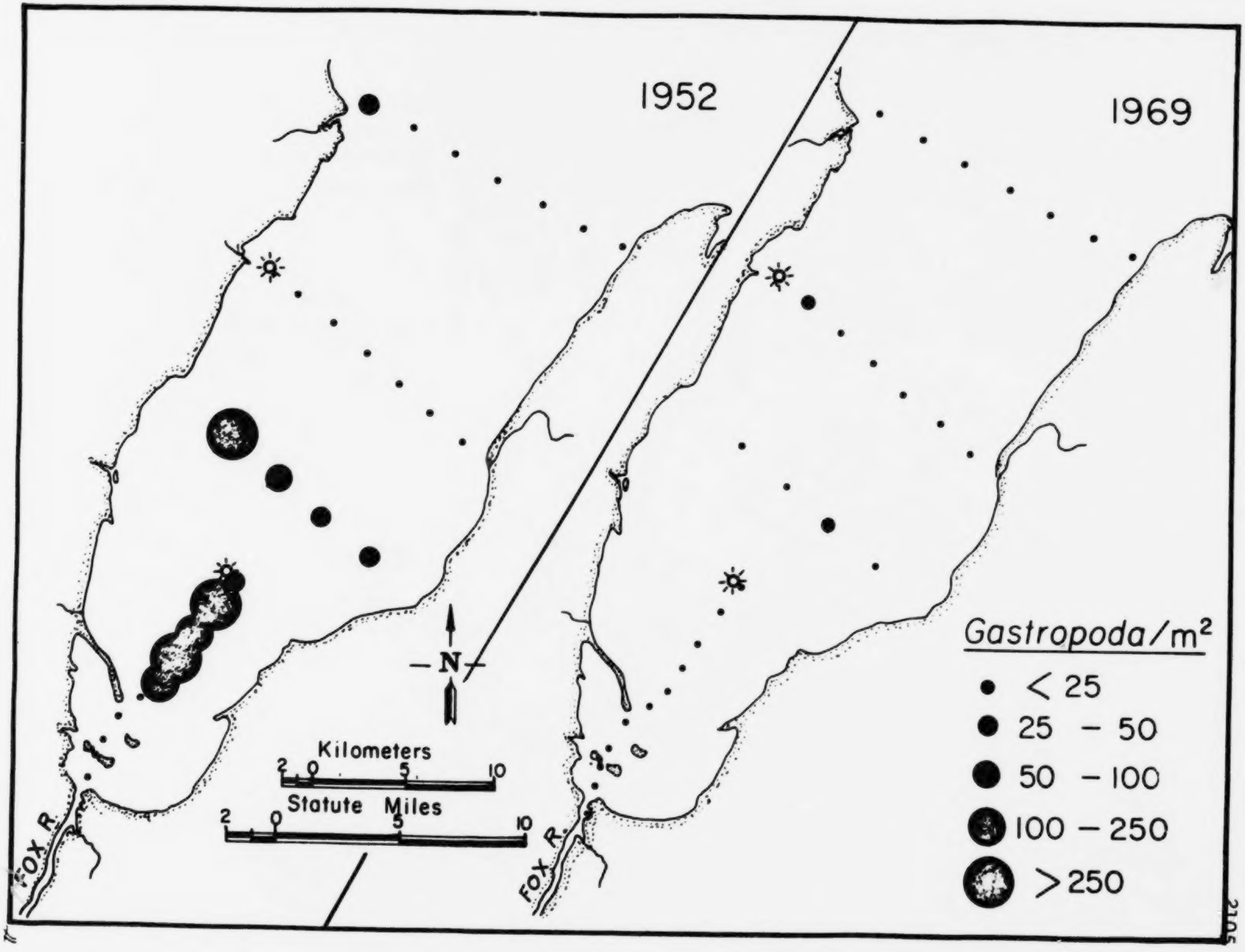

1952
1969
FOX R.
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
Oligochaeta/m²
• < 100
● 101 – 1000 (light pollution)
● 1001 – 5000 (moderate pollution)
5001 – 10,000
> 10,000
(heavy pollution)

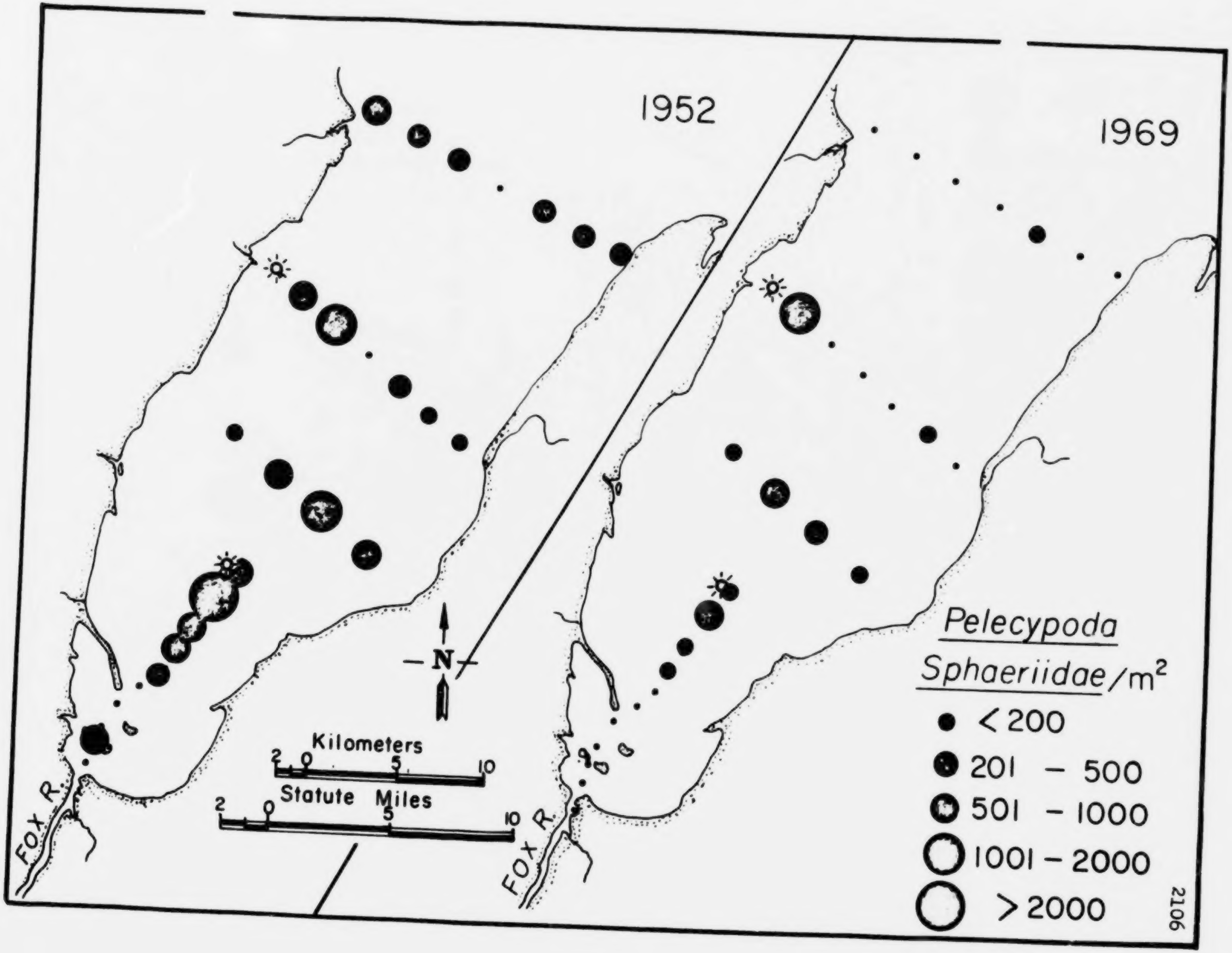
2102

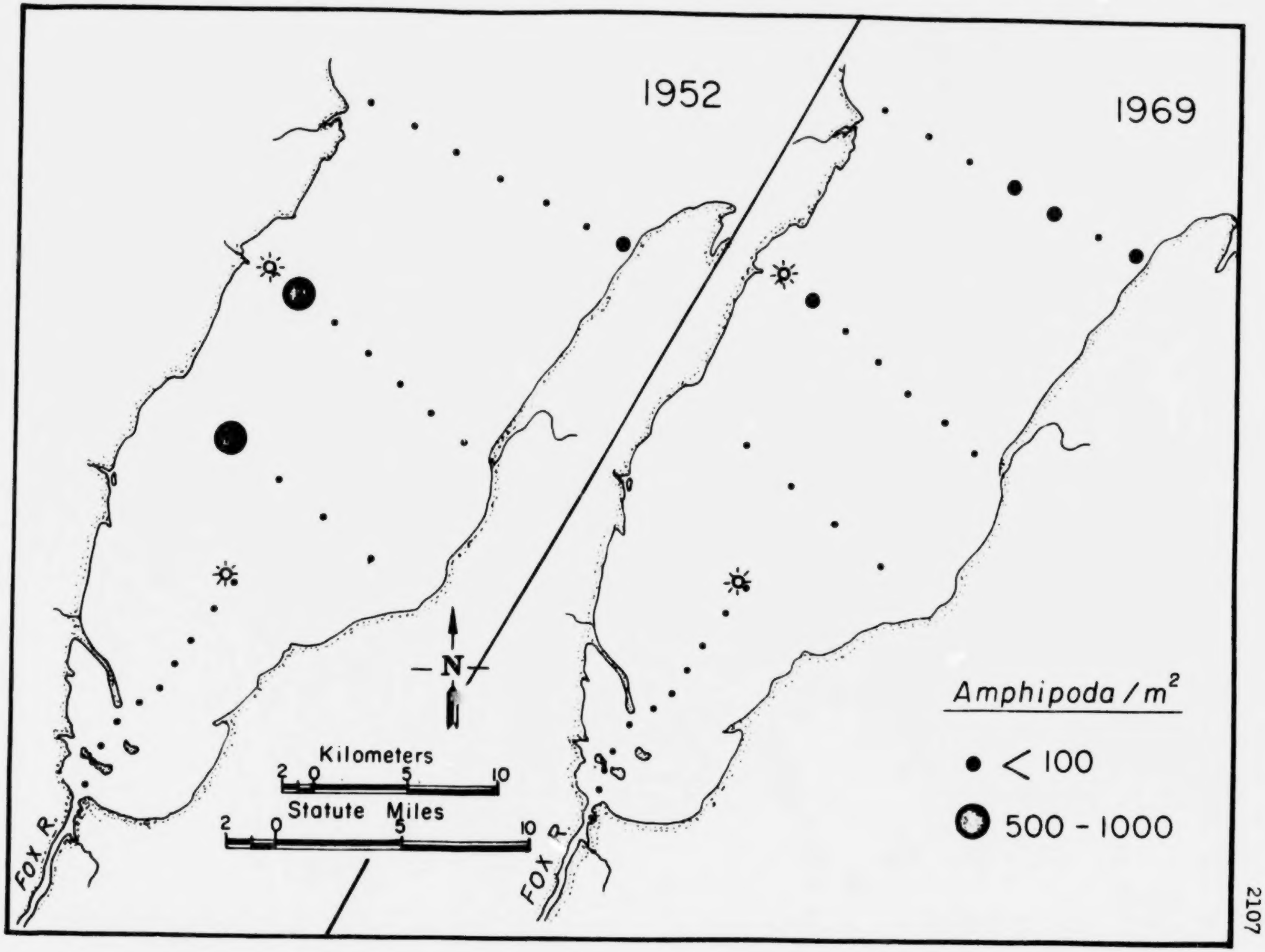

1952
1969
FOX R.
FOX R.
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
Oligochaeta
● < 60% (good condition)
◍ 60%80%(doubtul)
○ > 80% (highly polluted)
2103

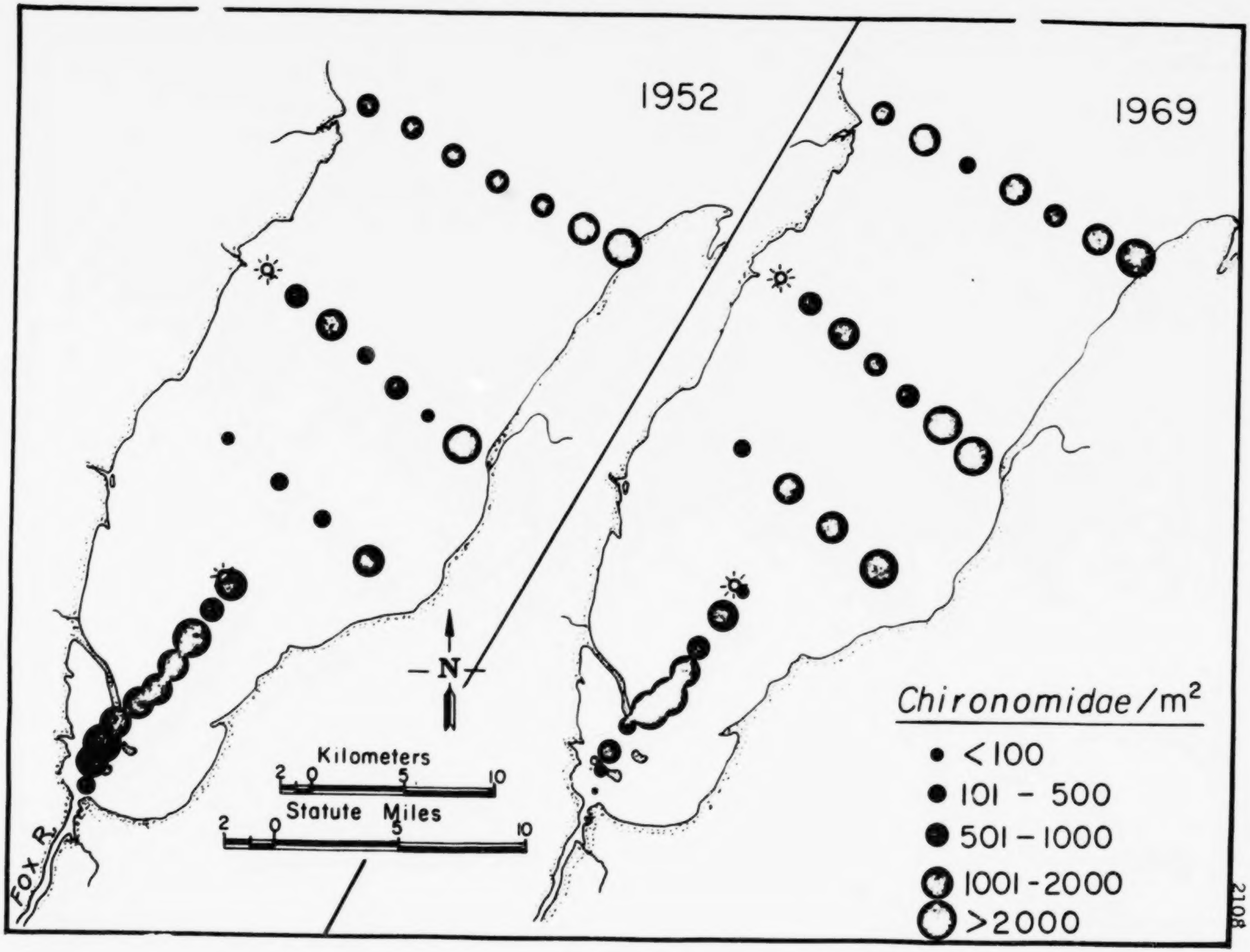

1952
1969
Hirudinea /m²
< 25
25 - 50
50 -100
100 - 250
> 250
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
Fox R.
Fox R.

2104


1952
1969
Gastropoda/m²
● < 25
● 25 – 50
● 50 – 100
● 100 – 250
● > 250
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
FOX R.
FOX R.


1952
1969
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
FOX R.
FOX R.
Pelecypoda
Sphaeriidae/m²
● < 200
● 201 - 500
● 501 - 1000
○ 1001 - 2000
○ > 2000
2106

1952
1969
N
Kilometers
2
0
5
10
Statute Miles
2
0
5
10
FOX R.
FOX R.
Amphipoda / m²
● < 100
● 500 - 1000


1952
1969
N
Kilometers
2 0 5 10
Statute Miles
2 0 5 10
FOX R.
Chironomidae/m²
• <100
● 101 - 500
● 501 - 1000
○ 1001-2000
○ >2000
2108

Curriculum Vitae
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A. M. Beeton
Curriculum Vitae

Present Address: 340 Park Circle, Cedarburg, Wisconsin
Born: August 15, 1927, Denver, Colorado
Married

Education:

Jackson High School, Jackson, Mich., graduate 1946
Jackson Jr. College, Jackson, Mich., 1946- Feb. 1949
University of Michigan, Ann Arbor, Mich., Sept. 1949-Feb. 1958.
B.S. 1952; M.S. 1954, Ph.D. 1958.

Experience

Academic Appointments:

University of Wisconsin-Milwaukee, professor of zoology, Feb. 1966-present.

University of Michigan, Research associate in zoology, Sept. 1964-Feb. 1966; lecturer in civil engineering Sept. 1961-Feb. 1966.

Wayne State University, lecturer (graduate limnology course) June 1957-Sept. 1961; instructor, Sept. 1956 - June 1957.

University of Michigan, teaching fellow, Feb. 1956 - June 1956; Sept. 1954-June 1955; Sept. 1953-June 1954; Sept. 1952-June 1953.

Government Service:

U.S. Fish and Wildlife Service, Ann Arbor, Michigan (GS-3) June 1955 - December 1955; (GS-5) June 1956-Sept. 1956; (Fishery Biologist Res.) June 1957-Feb. 1966, Chief,Environmental Research Program.

Travel to India, Israel and Pakistan, 1963 and 1964, in connection with the Bureau's Foreign Currency (P.L. 480) program to review fishery research being sponsored through this program.

Institute for Fisheries Research. Michigan Conservation Department, June 1962-Sept. 1962; June 1953-Sept. 1953; June 1954-Sept. 1954.

Consulting Appointments

1967-69: U.S. Army Corps of Engineers, Buffalo District, New York. Member, Board of Consultants, on effect of Corps' dredging activities on pollution in the Great Lakes.

1968-present: Metropolitan Sanitary District of Greater Chicago

1968: University of Illinois.

Academic Activities:

Associate Director (Biology), Center for Great Lakes Studies, University of Wisconsin-Milwaukee, 1966-present.

Member, Executive Committee, Division of Biological Sciences, University of Wisconsin (all-university committee) 1966-67, 1967-68.

Member, all-university Council for Marine Studies, University of Wisconsin, 1967-68, 1968-69.

Honors, Grants & Awards

University of Michigan, Lit. College scholarship, 1950-51
American Ornithology Union, student membership award, 1954
Herbert E. Boynton, graduate school scholarship, 1956.
Phi Kappa Phi
James, W. Moffett Publication Award from U.S. Bur. Commercial Fisheries
for best scientific paper publised (1968) in 1967.

U.S. Army Corps of Engineers, Buffalo District, Contract 1968-69 ($20,005)
to study the effects of dredging and disposal on the Great Lakes.
U.S. Dept. Interior, Bureau of Commercial Fisheries, Grant($3,700, 1968;
($7,563, 1969) to study the population dynamics of juvenile alewife and coregonids of Green Bay, Lake Michigan.
National Science Foundation, Wisconsin Sea Grant Program, 1968-69, $11,400
to study various aspects of the eutrophication of Green Bay.

Research Interests

My major research interests have been in the behavioral physiology of Crustacea and the eutrophication of the Great Lakes, although I have made contributions to several aspects of the limnology of the Great Lakes (see attached list of publications).

Studies on photoreception in the freshwater mysid, Mysis relicta, employing behavioral methods, demonstrated the nature of spectral sensitivity, dark-adaptation, and phototropic response in this organism and established general methods for similar studies of this group of organisms in the marine as well as the freshwater environments. These studies have been duplicated by other investigators on marine mysids. The laboratory investigations of photoreception and photo response of M. relicta provided information essential to the proper interpretation of field data on the vertical migration of M. relicta in Lakes Huron and Michigan. This latter study showed that light "triggers" and controls their migrations, while thermal conditions interact with and modify the influence of light. The field data showed that as the length of day decreased following the summer solstice, the mysids ascended progressively earlier each evening and descended later each morning. Moonlight and fog influenced the time as well as the amplitude of the vertical migrations. The mysids frequently migrated through the thermocline when first ascending, but later at night the majority occurred in or immediately below the thermocline.

Prior to 1959 the general opinion was held that although the Great Lakes must be aging, i.e., undergoing eutrophication, it was not recognized that eutrophication could be demonstrated on bodies of water as large as the Great Lakes. My study of environmental changes in Lake Erie, which was first presented at the meeting of the Lake Erie Fish Management Committee in May 1960, and subsequently published in the Transactions of the American Fisheries Society in 1961, presented evidence of accelerated eutrophication in this Lake. This work directed attention to an important aspect of Great Lakes limnology that had been ignored previously. The significance of this contribution is reflected in the importance of studies of eutrophication in current research programs of the U.S. Bureau of Commercial Fisheries, U.S. Public Health Services, several universities, and other organizations.

The results of my recent study demonstrate that several changes commonly associated with eutrophication in small lakes have occurred in the Great Lakes. These changes apparently reflect accelerated eutrophication in the Great Lakes, due to man's activity. Chemical data compiled from a number of sources, dating as early as 1854, indicate a progressive increase in the concentrations of various major ions and total dissolved solids in all of the Lakes except Superior. The plankton has changed somewhat in Lake Michigan and the plankton, benthos, and fish populations of Lake Erie are greatly different today than those of the past. An extensive area of hypolimnetic water of Lake Erie has developed low dissolved-oxygen concentrations in late summer within recent years.

Professional Membership

Phi Sigma , Beta Chapter, secretary 1954-55
Sigma Xi
American Fisheries Society
American Institute of Fishery Research Biologists
American Society of Zoologists
Societas Internationalis Limnologiae
American Society of Limnology and Oceanography; Treasurer, 1962-present,
    member, Board of Directors
International Association for Great Lakes Research, Board of Director,
    1967 - present; Program Chairman, 11th Conference on Great Lakes
    Research, May 1968, Attendance - 550+.
Midwest Benthological Society

MR. WILSON: Now, I would like to make my comments on this report.

From the foregoing data, it is apparent that the condition of the bay is worsening and at a rapid rate. Of primary concern is the fact that during this time, the rivers emptying into the bay and the sources of pollution on them have been under the scrutiny of the responsible Wisconsin pollution control agency.

Using figures compiled by the Wisconsin Department of Natural Resources, we can make the following comparisons on BOD and suspended solids loading of the Fox River in a 20-year period ending in 1968. You get the picture here? In other words, I am going to be discussing loading factors that have been repoted on BOD to the Wisconsin Department of Natural Resources as against the study that I have submitted in 1969 as to the condition of the bay. All right?

In 1948, the municipal load was 23,980 pounds per day of BOD. The mill loads -- paper mills altogether in the Fox River, 288,020 pounds per day, giving a grand total of 312,000 pounds of BOD per day into the Fox River.

The suspended solids load in 1948 was 10,520 pounds per day. The mill load was 101,940 pounds per day, and the total was 112,460 pounds per day of suspended solids in the Fox River.

Now, I will read the 1968 figures -- this is the end of the 20-year period. Municipal loading, 26,714 pounds per day BOD. The mill loading has dropped to 276,740 pounds per day -- these are all admitted loadings. It is very important to understand this: that this is what the mills admit to dumping. Total, 303,454 pounds per day.

In 1968, suspended solids loadings -- municipal suspended solids loadings were not reported. Mill loading went from 101,940 pounds in 1948 to 248,500 pounds per day of suspended solids. I can't give you a total because the municipal suspended solids load was not reported.

The numbers applying to the Menominee, Peshtigo, and Oconto Rivers, while lower, show relatively the same changes. One might well ask, in view of what appears to be a net reduction in BOD -- admittedly a very small one -- how Professor Howmiller and Dr. Beeton were able to document such a drastic deterioration in the condition of the bay.

It is interesting to examine the suspended solids loading during this period. The contributions double. Might not a clue to the problem lie herein?

It is also instructive to understand fully the nature of the monitoring process, which is largely performed by the polluters themselves and, in fact, would include the contents of settling lagoons and basins that are regularly discharged to the river only under extremely rare circumstances. I hope that is clear: that the settling lagoons and basins are reported under only extremely rare circumstances.

The Quirk-Lawler-Matusky study of the Fox River, funded by the Wisconsin Department of Natural Resources, included among its recommendations that "... an economic alternative to advanced treatment facilities would be flow augmentation."

We note that Michigan's pollution control agency has accepted this principle with regard to the huge new Mead paper mill at Escanaba, where the proposal is to, in times of low flow of the Escanaba River, pump water out of Lake Michigan and introduce it upstream from the mill. This is designed to maintain an adequate dissolved oxygen in this critical stretch of the river. Where, however, do the pollutants and solids go after they are thus diluted? Gentlemen, these measures have been proven unsatisfactory in the past. Why are they permitted now and accepted in future planning?

In April, at the Lake Michigan Conference in

Milwaukee, I raised the question whether it was necessary to demonstrate that a specific pollutant crossed the State line in Green Bay before the Federal Government could exercise its jurisdiction in those waters. Mr. Stein interrupted at that point to indicate that the Federal Government viewed Green Bay as clearly within their purview.

The question has come up again, however, and a conflict of interpretation within and between the FWQA and the State of Wisconsin has not been resolved. Wisconsin claims harbor areas and river mouths as being within the jurisdiction of Wisconsin statute. No one has defined how far out into the bay these areas extend. Unless some clearly quantitative limit is placed on rivers and harbor areas of influence, presumably all of Lake Michigan could be claimed as a mixing zone for one or another State's river or harbor. Apparently FWQA cannot or will not act in the Green Bay section of Lake Michigan until this matter is decided.

In Green Bay, on June 23, 1970, in a hearing before the Wisconsin Department of Natural Resources, evidence was presented indicating that the Fort Howard Paper Company was now discharging some 40,000 pounds of BOD per day and 8,000 pounds of suspended solids per day into the Fox River as compared with their 1968 loadings of 32,720 pounds of BOD and 27,880 pounds of suspended solids per day.

It was also brought out that they intended to reduce their loadings through the installation of advanced treatment facilities to 10 percent of their present contribution. Their new orders call for abatement to 25,400 pounds of BOD and 27,300 pounds of suspended solids per day. Why do they not call for a maximum of 4,000 pounds of BOD and 800 pounds of suspended solids per day? And why, above all, did it require the citizens to pool their money to legally force this information into the open? Why did not the Wisconsin Department of Natural Resources determine this information for themselves? As yet, we have not received a new order for this mill, although presumably it is forthcoming.

The joint municipal-industrial treatment plant to be built in the city of Green Bay is designed to treat the mill wastes from American Can and Charmin to effect a 90 percent removal. Green Bay Packaging is constructing a reverse-osmosis plant to remove 90 to 100 percent of their effluent load to the Fox River. But the State orders trail behind the technology available. In 1968, admitted loadings to the Fox River from both industrial and municipal sources totalled some 303,450 pounds of BOD per day.

Technology permits this to be reduced to 10 percent of that total. The Wisconsin Department of Natural Resources is calling for a reduction to only 87,065 pounds of BOD per day from the paper mills, plus an additional municipal load.

We ask that total contributions to the Fox, Oconto, Peshtigo, Menominee and Escanaba Rivers be put at 10 percent of their present loadings, and that the ominous rise in suspended solids be immediately investigated at the source. We also request that this conference begin the procedures necessary to establish effluent standards on all waters affecting Lake Michigan. We request further that the States establish adequate and uniform monitoring of discharges that will permit complete public surveillance of all pollutional sources.

And, finally, the Wisconsin Ecological Society would like to commend the excellent report, "Physical and Ecological Effects of Waste Heat on Lake Michigan," prepared by the Great Lakes Fishery Laboratory of the Fish and Wildlife Service of the Department of Interior. This is another piece of excellent work done by that able laboratory.

For the first time, the actual physical process of introducing large amounts of hot water has been described. Rejecting the notion that the heated water would intermix with the entire volume of water in the lake, and the equally simplistic view that the warm water plumes would spread out evenly over the entire lake and quickly evaporate, they have quite accurately delineated the complex routes possible to this huge mass of interjected hot water.

We completely concur in the conclusion of the report that no significant discharge of waste heat into Lake Michigan should be permitted. (Applause)

MR. STEIN: Thank you, Mr. Wilson.

Mr. Frangos.

MR. FRANGOS: Just a few quick comments.

I recognize that much of this presentation did not bear on the thermal question, but it is certainly important to the well being of the lake.

I am not sure I understand it, but I think the best way is for me to say again -- I said it at the last conference -- we have no jurisdictional problem in Wisconsin from the State's point of view about Green Bay and the Fox River and the tributaries to the lake. We have included this in all of our listings to the conferees, and we have proceeded on a schedule that is compatible with the overall requirements of this conference.

On the Fort Howard situation, I really can't comment, or I don't think I should at this time since this is under advisement by our Department's legal unit. But Mr. Wilson is indeed correct that a decision will be forthcoming in the near future.

I hesitate to comment on the effectiveness of the reverse-osmosis in the Green Bay Packaging operation as a demonstration program, and I don't have the confidence in the capabilities of that process at this time that Mr. Wilson has.

I think his points are well taken on increasing surveillance over pollution generally in the State and certainly on the Fox River. The Legislature has responded to our Agency's request for increasing our monitoring. We have been successful in getting funds, and we will be indeed increasing our surveillance, and we have designed a monitoring system for the Fox River, and we hope to have that on line within the next month.

MR. WILSON: Mr. Stein, may I just respond to one point that Mr. Frangos has made?

The hangup -- if you want to put it that way -- with the jurisdictional matter is simply that when you classify a stream as industrial cooling, you also extend the area of influence of that stream out beyond the harbor mouth. Now, the actual measurement of what that harbor influence is, that area of influence by the harbor, the actual mileage out into the bay, has not been defined, and as I understand this from the highest people in the FWQA in Chicago, there is no way that they can insist that Lake Michigan standards be enforced in areas that you say, as the head of the Wisconsin -- your pollution control agency -- that you say are areas of influence.

Now, does that clarify the problem?

MR. STEIN: We have the highest people right to my left.

Again, let me indicate what the situation is. We go over this again and again and again, and I keep quoting the same man -- Oliver Wendell Holmes. He said: "Any bright young man can tell me what the law ought to be, but it takes a student to know what the law is and what we have to enforce."

The Federal law is clear on this. We have to have two criteria present to have a Federal enforcement action if we are going to proceed on Federal initiative. The first thing, there has to be interstate waters or navigable waters. I don't think that is the question here. Then, if we are to proceed on our own initiative for a cleanup, whether it is under the standards provision or whether it is under the conference provisions as we have here, we have

J. F. Wilson

to have pollution in one State endangering the health or welfare of persons in another State. You have to have both of those things.

There is an exception to this. That is where we have been asked to intercede in intrastate situations by a State. As I read this, we have been asked in here by Governor Kerner on an intrastate situation in Illinois as well as an interstate one. We have never gotten a request like that from the Governor of Wisconsin. Therefore, Federal jurisdiction, in Wisconsin, is limited to pollution which is interstate as well as affecting an interstate or navigable water. This effectively pulls the teeth of the whole thing in Green Bay.

But what you have just said is exactly what we are talking about. First of all, Lake Michigan is supposed to be suitable for all water uses. Now, the point is: What kind of an imaginary line is supposed to be drawn across the mouth of the Fox River? There is one, there must be, because if there was not then obviously the water does not qualify.

Sir, what I want to point out is: while there may be an imaginary line, there is a very definite line which is the border of Wisconsin and the neighboring State, and all of the waters you are talking about lie well within the boundaries of Wisconsin, and they are intrastate in nature.

MR. WILSON: They are intra?

MR. STEIN: Yes.

MR. WILSON: Oh!

MR. STEIN: At least the effect is within. The water may be interstate but the effects that you are talking about are also all within Wisconsin -- the same State upon which the discharge that you are talking about has the alleged causal effect.

Now, I would like to move back, and I think I may have misled you. The waters are interstate but the discharge point and the alleged damage point and the causal connection with them all relates to points within Wisconsin, and when that happens, our jurisdiction is limited unless the Governor asks us in, and that hasn't happened.

Now, we have a proposed amendment to the Federal law which would remove this, but the Congress hasn't acted on that yet.

MR. WILSON: What is the name of that bill? Do you know that offhand?

MR. STEIN: We can get that for you. But the House has not had hearings on this. Senator Muskie's Committee has had hearings, but we haven't had any movement of that legislation yet.

MR. WILSON: All right. I think, sir --

MR. STEIN: Let me continue on this. We recognize the problems in the law. But I would suggest that in those instances that you have to remedy the law or get the request of the Governor of a State in order for us to exercise jurisdiction, at least complaints about the efficiencies, etc., should be directed to the places where they can do the most good. This forum here can just carry this out. But I recognize this and the Administration recognizes this. We can't do anything else.

MR. WILSON: In other words, now, if Michigan would request some action on Green Bay, they would claim that they were affected?

MR. STEIN: Well, if they said they were affected -- I never heard them say that.

MR. WILSON: No. I see the problem.

MR. STEIN: There is another feature in the law. If Michigan asks us, we have to go in there in a mandatory way. We have no option.

MR. WILSON: What about if Illinois asked you?

MR. STEIN: What, that Green Bay affects Illinois?

MR. WILSON: Would that have to be contemplated?

MR. STEIN: Well, surely we would go in, but they sure enough have to contemplate it.

We get this again and again, and I know you will be facing your citizens over and over again. We have had the same problem. It can be best illustrated by our case that is currently in progress on Lake Superior. People were complaining about discharges to Lake Superior from Reserve Mining Company, which all hands agree is putting out 67,000 tons -- get that figure -- a day of taconite tailings wastes into the lake at Silver Bay, Minnesota. They asked "Why, why, why couldn't you clean this up? Look at all this material coming out."

Because we didn't have an intrastate request from Minnesota, we had to prove before we had jurisdiction that these materials were getting over into Wisconsin and, in fact, deteriorating water quality in Wisconsin. We had 30, 40, 50 miles of open lake to trace these pollutants across or this material across -- I don't think the company considers them pollutants yet. We had to trace them across remarkably clean waters, and we had to spend a fiendish amount of money and resources to prove that.

Now, this is the state of the Federal law now, and unless you people recognize that, you will have a very difficult thing to understand. We stand on what our jurisdiction is. I know the people around the shores of Lake Superior who talk in the same terms you do of money, people and staff coming out, were very impatient with us in not being able to move in within days or weeks after we entered the case. But this was not possible until we felt or the Federal people felt that interstate pollution could be demonstrated.

MR. WILSON: Thank you.

MR. STEIN: I hope this is helpful, because we are going to run into this over and over again.

MR. DUMELLE: Mr. Stein, let me just ask you a clarifying question.

Mr. Currie, when he was sitting here a little while ago, talked about the chloride situation, and we have this allegation that some 1,500 tons of chlorides as sodium chloride are going into the lake at Manistee every day.

Would it be necessary for us to ask Governor Ogilvie to point this out to the Federal people in order to get to abatement of this discharge, in order to show an interstate effect? Or can we assume that Lake Michigan, because of its mixing, will carry this kind of a persistent discharge all over the lake?

MR. STEIN: As I read the request from Governor Kerner which, as far as I can see, is endorsed by Governor Ogilvie, we already have this request from Illinois in sufficient terms to give us jurisdiction over that and investigate that and correct that if that is the problem.

MR. DUMELLE: Thank you.

MR. STEIN: This has already been done.

May we have Mr. Winston? Is he here?

Vance Van Laanen? Is he here?

While you are coming up, Mr. Van Laanen, I would like to take this opportunity to introduce a telegram into the record from Carole Magnus, addressed to several of the conferees and Mrs. Edgar Wilkinson's statement — she had to leave — and Catherine Quigg's statement, who also had to leave. They have entered statements for the record. I would like to put those in.

(The following telegram was received from Carole Magnus, Secretary, Manistee County Anti-Pollution Organization.)

"MACAPO fully supports strongest action to prohibit thermal pollution. Urge push for prejudgment, guidelines."

STATEMENT OF MRS. EDGAR WILKINSON,
SOCIETY AGAINST VIOLENCE TO THE
ENVIRONMENT, HIGHLAND PARK, ILLINOIS

MRS. WILKINSON: My name is Ann Wilkinson from Highland Park, Illinois, and a member of the Society Against Violence to the Environment.

I am not speaking for SAVE but as a concerned citizen and as a mother.

I grew up in Highland Park and used to enjoy swimming in Lake Michigan. I have a 4-year old and I wouldn't dare let her go in the lake in its present state. I hope she will be able to some day.

If there is any doubt of the effect of adding heat to the lake from atomic powerplants or any other sources, we should not add any heat. We can't afford to take a chance.

You've seen the button, "Don't Do It in the Lake." I don't think that anyone -- business or private -- should be allowed to put heat in the lake.

STATEMENT OF MRS. CATHERINE T. QUIGG, BARRINGTON, ILLINOIS

MRS. QUIGG: Electric utility companies to the contrary, nuclear powerplants are not man's good neighbors.

Existing and proposed nuclear powerplants are designed to pour billions of gallons of heated water into Lake Michigan each day. The Zion plants alone will contribute 2 billion gallons of heated water a day to the lake.

I am aware of the decline of the lake due to pollution and I am afraid that nuclear power siting with thermal discharges along its shore will hasten this decline. Not just the Zion plants but all powerplants being built around the lake deserve our serious concern with relation to their environmental effects.

At the very least, we should insist that electric companies utilize current technology such as cooling towers and cooling ponds to prevent aquatic damage. Why don't we -- for once and for all -- dispel three power company myths:

1. The myth that cooling towers cause adverse atmospheric conditions.

Mrs. C. T. Quigg

Investigations by the FWQA of fogging problems from natural and draft towers presently operating in the eastern United States refutes this position. Reports indicate that natural draft towers did not produce ground level fog or drizzle under any weather conditions. Plumes of steam from cooling towers rarely dropped below the top of the tower for an extended distance, and generally dissipated within a few hundred feet of a tower.

The FWQA report, dated September 1968, went on to say, "In general, undesirable meteorologic effects from towers can be prevented or controlled to a large degree through modern design, such as effective drift eliminators and air-flow control. In situations where problems arise, the area affected is limited to that immediate to the tower installation."

Research on cooling towers by Eric Aynsley, research chemical engineer, Illinois Institute of Technology, confirms the above conclusions. Initial findings of his studies at the Keystone Generating Station near Indiana, Pennsylvania, state that local fogging problems and icing from tower plumes do not present a problem.

2. The myth that cooling towers are too costly.

According to recent studies, installation of cooling equipment to control thermal pollution from water discharges from powerplants would add about 30 cents a month to the average customer's electric bill. I'll pay that much to keep the lake alive.

3. The myth that cooling towers are so unsightly the public doesn't want them.

This is the weakest argument of all. The choice between unattractive cooling towers and a dead or unsightly lake is an easy one to make.

I recommend that we insist on alternate cooling methods for thermal powerplants near Lake Michigan. We should not allow Lake Michigan to become the power company's private waste sink at our great expense and that of future generations.

MR. STEIN: Just in case you think I am out here on my own, I have received another telegram from another one of my bosses, which I will read into the record now:

"Though the exact extent of potential damage to Lake Michigan by the introduction of massive quantities of waste heat is yet undetermined, there is enough evidence to make it clear that consequences could be catastrophic. Federal reports which have been presented to this conference cite the dangers and demonstrate there are at least six reasonable and feasible alternatives to discharging heat wastes to the lake from powerplants. The conferees should act immediately to establish tough standards on these plants prohibiting the discharge of waste heat to the lake. There is no valid reason to gamble with the future of this priceless resource when, in fact, such a risk can be avoided with available technology." Signed Senator Gaylord Nelson.

Mr. Van Laanen.

STATEMENT OF VANCE VAN LAANEN, PRESIDENT, WISCONSIN RESOURCES CONSERVATION COUNCIL, GREEN BAY, WISCONSIN

MR. VAN LAANEN: My name is Vance Van Laanen and I reside in Suamico, Wisconsin. I speak on behalf of the Wisconsin Resource Conservation Council of which I am President, and the newly formed Lake Michigan Federation, of which I am Chairman.

During the past week, Mr. John Wilson, who represents the Wisconsin Ecological Society, and I have concluded negotiations with the Wisconsin-Michigan and Wisconsin Electric Power Companies in lieu of intervening in the licensing of their facility at Point Beach. I know it was earlier reported in the press that we had reached an agreement and that is partially correct. We had, in fact, reached an agreement in principle. In the wording of that agreement, however, the principle enforcement mechanism was to have been the Atomic Energy Commission itself. Subsequent discussions with AEC counsel, which I will not quote directly, disclosed the fact that the Commission had no intention of enforcing the agreement even though they did agree to accept the document for inclusion in the official docket for Point Beach unit number one. This original agreement had then to be renegotiated with different enforcement mechanisms and I believe that a portion of that document is relative to the proceedings here.

I have included a copy of the agreement together with my remarks for inclusion in the record. (See Pp. 2141-2145)

The agreement states in part: "The intent of this agreement, which all of the provisions thereto are understood to promote and establish, is to create an obligation on the Applicants to make every reasonable attempt to reduce all deliberately discharged radioactive wastes from Units 1 and 2 of the Point Beach Nuclear Plant to zero." And again: "The Applicants will proceed forthwith to obtain proposals from Westinghouse and/or other suppliers for equipment or systems that are applicable to the Point Beach Nuclear Plant and that would result in reducing the discharge of radioactive substances in conformance with the intent of this Agreement."

I firmly believe that this language, arrived at through negotiation in good faith, firmly establishes the principle of zero release of radioactive materials to the environment as a technically feasible and economically practicable reality. Further, I firmly believe that it demonstrates an awareness on the part of the utility industry, or at least that portion of it that is environmentally responsible, that the general public is not willing to settle for a lenient standard, even though no immediate danger to health and welfare can be established, when the technology is available, at reasonable cost, to meet more stringent standards. I commend the applicants, Wisconsin-Michigan and Wisconsin Electric Power Companies for their willingness to take this important step in environmental protection and I strongly urge the conferees here to require no less of the other utilities constructing reactor generating facilities around the lake.

V. Van Laanen

During these same negotiations, the question of thermal loading of Lake Michigan came up, as you might suspect. The applicants asked us to withdraw consideration of the thermal aspects as it was not relevant, in this situation, to the Atomic Energy Commission proceeding. We agreed with the applicants that Wisconsin regulations effectively direct the consideration of thermal discharges to this conference. We, therefore, request of this conference that it require the abatement of thermal discharges to the full extent that is technically feasible and economically practicable, or more simply that it require the full application of the state of the art in thermal abatement techniques. I would like to take a moment or two to explain why I believe this request to be both reasonable and timely. The fundamental issue in thermal control involves the question of whether the utility industry, or any other, possesses the right to contaminate the environment beyond the limits of necessity. The question is not technical, it is a moral question. I say it is not a technical question because if you leave out all of the economic qualifiers, it is obviously undesirable to inject large amounts of heat into a natural cold water system.

The traditional approach to pollution control in this country has been defensive and negative. This approach has developed over a period of many years from an initial, basic, philosophy of using the environment to its maximum capacity to carry away wastes. The environment has been thought of as having a "self-purification capacity" that can and should be legitimately used for waste disposal. In this way, of course, the costs of waste control and disposal could be minimized, and it has been an accepted idea that to require additional waste treatment would be to place an unreasonable economic burden upon industry. So long as no obvious damage could be shown wastes from communities and from industry could be released to the environment without further justification.

It thus became the practice to establish environmental and human protection criteria that were based upon a concept of obvious or provable harm. Once such limits are established, of course, they become "dumping" criteria, in the traditional sense that the costs of pollution control are customarily minimized by releasing the maximum amount of wastes that can be absorbed by the environment without evident and obvious harm. Quite obviously, this approach also results in the maximum pollution of the environment that is tolerable on a short-term basis.

We now have a history of attempting to clean up pollution after the damage has been done, and that procedure is both expensive and unsatisfactory. It leads inevitably to an environment that is barely tolerable.

What is required instead is a new approach to environmental protection which is based on prevention rather than cure. It should no longer be necessary for those desirous of protecting the environment to bear the burden of proof that each and every discharge will, in fact, result in X-amount of damage. The burden of proof should be on the other foot and the potential polluter should be required to show the absolute necessity of making any releases to the environment. Instead of making maximum use of the environment for waste disposal, we must begin to think in terms of the maximum protection of that environment and the minimizing of wastes dispersed to it. The crucial question must become not how much waste can the environment tolerate, but how much can be reasonably kept out? While the concepts of air and water quality standards have served adequately as a beginning in pollution control, we must take the next step and begin to place controls on the effluent discharges where they originate. The only supportable justification for the release of any contaminant to the biosphere now is the absolute demonstration of the necessity for it.

The Fish and Wildlife Service has presented to this conference a clearly viable alternative to the once-through cooling system. It has shown that these alternatives are technically feasible and economically practicable. There is no question that the prohibition of once-through cooling is the only reasonable response by the conferees.

Finally, I suggest that adopting stringent thermal standards now would be not only reasonable but timely. A recent issue of Limnos magazine contained an excellent article by Mr. Mayo. In the article, he described ways for private citizens and conservation groups to be more effective in promoting sound environmental policies and even suggested some excellent strategems for environmental litigation.

Let me insert here that I agree with everything Mr. Mayo said. What I deplore is that he had to say it at all!

I suggest that the conferees here would be shocked to pick up tomorrow's morning paper and see an article by the Chicago Chief of Police outlining methods for citizens of this city to preserve law and order. In the area of crime control, we have long passed the time of the vigilantes. The democratic process in the area of pollution control, as I understand it, consists of legislative acts and regulatory enforcement. Yet everyone here is aware of a continuing necessity for litigation on

V. Van Laanen

environmental matters initiated by the citizen. Although litigation before the courts of the land is a viable extension of the democratic process, I suggest that it indicates some weakness back on the legislative and regulatory levels. Litigation is rapidly becoming unavailable as a tool for the private citizen. The costs involved are almost prohibitive. Conservation organizations are less and less able to mount significant environmental actions in the courts, but the need for such litigation has not abated.

When the public is frustrated at the legislative and regulatory levels, and when the courts, for economic reasons, are no longer available, I suggest that the confrontation over the environment will still occur. The logical destination in the democratic tradition for that confrontation is the street. I personally would deplore such a development as would most other responsible conservationists, but I would remind the conferees that the problems are severe, widespread, and increasing. More people are becoming aware and involved every day. As environmental degradation increases in intensity its visibility factor increases exponentially. This increase in the visibility factor will inevitably attract the attention of greater and greater numbers of the public. The time for strong, purposive regulatory action is now.

(Following is the agreement referred to by Mr. Van Laanen.)

AGREEMENT

This agreement is entered into by and between Wisconsin Electric Power Company and Wisconsin-Michigan Power Company hereinafter called "Applicants" and John F. Wilson and Vance J. Van Laanen and a number of organizations represented by them as set forth in their petition in the proceedings before the Atomic Energy Commission of the United States of America under docket No. 50-266, including the Wisconsin Ecological Society, Inc. and the Wisconsin Resources Conservation Council, hereinafter called "Intervenors."

Applicants have in said proceedings requested that the Atomic Energy Commission issue them an operating license for the Point Beach Nuclear Power Plant Unit number one at Two Creeks, Wisconsin. Intervenors have petitioned the Atomic Energy Commission for leave to intervene in such proceedings and for a public hearing in the matter of the issuance of such requested operating license stating as their view that it is desirable that no discharge of radionuclides be made to the environment and that the present state of the art is such that no radionuclides need be discharged to the environment.

The intent of this agreement, which all of the provisions thereto are understood to promote and establish is to create an obligation on the part of 1, the Applicants:

> To make every reasonable attempt to reduce all deliberately discharged radioactive wastes from Units 1 and 2 of the Point Beach Nuclear Plant to zero.

and on the part of 2, the Intervenors:

> That upon satisfactory demonstration of applicants' intention to meet the above stated obligation, to forthwith withdraw their petition to intervene in the proceedings before the Atomic Energy Commission under docket No. 50-266 and withdraw their request for a public hearing on the request of applicants for an operating license.

The provisions agreed to by Applicants and Intervenors intended to implement this agreement are as follows:

1. That Intervenors will forthwith withdraw their petition to intervene in the proceedings before the Atomic Energy Commission under docket No. 50-266, and withdraw their request for a public hearing on the request of Applicants for an operating license.

2. The Applicants will proceed forthwith to obtain proposals from Westinghouse and/or other suppliers for equipment or systems that are applicable to the Point Beach Nuclear Plant and that would result in reducing the discharge of radioactive substances in conformance with the intent of this Agreement.

The Applicants will within 60 days after receipt of these proposals make their evaluations and place orders for such equipment and systems.

3. That the following paragraph will be submitted forthwith by Applicants to the Atomic Energy Commission with a request that it be incorporated into and become a part of the said operating license requested by Applicant for the Point Beach Nuclear Plant, Unit number one at Two Creeks, Wisconsin to wit:

"On or before June 1, 1971, Applicants will submit to the Atomic Energy Commission application for modifications and/or additions to the Point Beach Nuclear Plant Unit number one to effect such changes in the equipment and/or operations that will reduce radiation exposures and releases of radioactive materials to unrestricted areas to as far below the limits specified in 10CFR20 as the state of the art in the reduction of such emissions will allow."

4. That if and when the Atomic Energy Commission grants such application for modifications Applicants will proceed to effect the modifications as approved by the Atomic Energy Commission according to the time schedule approved by the Atomic Energy Commission, or, if no time schedule is so established, within a reasonable time.

5. This agreement shall also apply in all particulars to the proceedings relative to Applicants' Point Beach Nuclear Power Plant Unit number two under docket No. 50-301 before the Atomic Energy Commission.

6. In the event Applicants fail to comply with the provisions for implementing this agreement, provision number five (5) shall be voided, and Applicants shall not proceed with the fuel loading of Unit two of Point Beach Nuclear Plant, at Two Creeks, Wisconsin.

7. This agreement shall be enforceable by the Atomic Energy Commission and any successor agency to the Atomic Energy Commission and in any proper court of record and shall be enforceable in such court through the remedy of specific performance or injunction if the court considers such remedy or remedies proper.

This agreement shall be executed in duplicate, one copy being retained by Applicants and one by Intervenors. Provision number three (3) shall be duplicated forthwith by applicant and submitted to the Atomic Energy Commission to become part of docket No. 50-266 if rules of the said Commission permit.

Witness our hands and seals this 5th day of October, 1970.

MR. VAN LAANEN: Thank you. (Applause)

MR. STEIN: Mr. Van Laanen, thank you.

Any comments or questions? If not, thank you very much, sir.

MR. DUMELLE: Mr. Stein, I just want to ask Mr. Van Laanen -- it is my understanding that the State of Maryland, in issuing its permit for the Calvary Cliffs Nuclear Plant, set the standard at 1 percent of the AEC 10CFR20 regulation, and that the State of Minnesota, I think, will set a 2 percent value.

Am I to understand you think that these are too loose, and your standard would be zero for radioactive discharges?

MR. VAN LAANEN: You get into an area here of what is zero and what is essentially zero. The Minnesota standards, as I understand them, and the Maryland standards are set right about at the point where the difficulty in calibrating the measuring instruments interferes with the ability to measure. So you are down in the area where it doesn't really make much difference whether you are talking a tenth or two-tenths or three-tenths. I think it has been substantially demonstrated that the state of the art -- in radiation control techniques -- is well beyond the Federal requirements for it. And, as I say, I think that the willingness of the Wisconsin Electric Power and Wisconsin-Michigan Power to take on itself the extra burden of agreeing to provide essentially zero releases amply demonstrates the fact that this is the case.

I certainly don't want to criticize the Minnesota standards or the Maryland standards. I think they are both very good.

MR. DUMELLE: What I am trying to establish is: Are your standards tighter than theirs, as you see them?

MR. VAN LAANEN: Well, first of all, you are trying to compare apples with peaches here. I am not that familiar with the Maryland standards. The Minnesota standards are -- by the way, those are not statewide standards, if I am not mistaken, those Minnesota standards apply to the -- what is the name of the plant? -- Monticello plant. They are specifically designed to cover a General Electric cooling water reactor with specific conformation at Monticello.

So the maximum permissible concentration factors for different isotopes are going to differ with that which will be coming out at Point Beach. If you are asking which standards will be lower, I think that probably there will be a smaller standard from the Point Beach Plant simply because it is a pressurized water reactor, and you don't have the gas emission problems that are difficult to handle that you do with the boiling water reactor. I do not have it calibrated down into specific MPC's at this point.

MR. STEIN: Any further questions?

This has come up. Mr. Van Laanen, don't run off because I have one more question. With the background you have demonstrated, I think this is a good time to ask you the question that has come up and people have asked me from time to time. If the electric utilities demonstrate, as you indicated in Wisconsin, before they build the plant that they are going to get down and get into this refined philosophic discussion of zero tolerance -- and I agree with your statements on that -- of the protection of the environment from releases of radioactive material into the environment, how do these plants on the one hand get so far on radiation, when on the other hand they didn't give the same comparable assurances of protection from discharge of heated water?

MR. VAN LAANEN: Are you asking now the plan --

MR. STEIN: No, no, it is a philosophic point. I am not talking, obviously, about the fossil fuel plants because this doesn't arise there. But if you are dealing with the nuclear plants and before the power industry goes ahead with that plant, they present full, complete, and documented assurances -- and I think they do a pretty good job of it --

MR. VAN LAANEN: Yes, they do.

MR. STEIN: -- that there won't be a nuclear discharge, and they have safety devices, etc., and have taken every precaution to protect the environment, the question is how come the plants already have done this with nuclear or radioactive material but they haven't done it apparently to everyone's satisfaction with the proposed heat discharges? Or should the industry, before it puts up a plant, be required to make the same kind of case, provide the same kind of assurances and the same kind of devices that it relates to protecting the environment from the discharge of heat as apparently it has done in assuring the protection from radioactive materials?

MR. VAN LAANEN: I would say absolutely, and I think the reason why they are not is because there has been a regulatory vacuum in that area.

The other thing I would say is that since the implementation of the NEPA Act I think this will probably be done or at least done to a certain extent. However, you bring up another very interesting point here, in that I do not personally see how it is possible to separate the heat from the radioactivity or vice versa. For the most part, the radioisotopes which come out of the these plants with the exceptions of the noble gases will come out as a part of the hot water discharge stream, and how are you going to physically or in any other way philosophically or ideally separate the isotopes from the waste heat in the waste disposal stream? I don't think it is possible. So I think it makes sense to do the same kind of study, the same kind on the noble gases -- environmental reassurance sort of thing -- with heat that you are doing with radioactivity because why the sense of water discharges, you can't separate them anyway.

MR. STEIN: By the way, I would thoroughly agree with you, and I don't know if you are familiar with it, but before these plants -- at least the thermonuclear plants -- came on, we did have many enforcement cases involving the uranium mining industry in the Colorado River Basin, and at this time I see a lot of parallels to where we are here.

MR. VAN LAANEN: Yes.

MR. STEIN: According to the Federal investigators and agreed upon by the State people, we went out and we at least determined there was excessive discharges of radium to those waters. These plants were operating. We got these pushed back, back, back. Then when the new plants came in the assurances were given that this wouldn't happen. But the restrictions for emitting radiation also applied to the existing plants.

So in radiation this was carried on, in large measure, into all plants such as the thermonuclear plants.

But I thoroughly agree with you that the protection of the environment is always one piece and you can't separate this. Any kind of emission that comes out of the plant that may affect the environment has to be accounted for. I am not just referring to the power industry. I don't want to single them out at all, because we have the same thing in mercury discharges.

MR. VAN LAANEN: Yes.

MR. STEIN: But it seems to me that if we have an example of how an industry can come forward and assure the public that it has taken all safety measures in protecting the public from radiation discharges, we might be much farther ahead if they would provide that same kind of assurance as to other potential hazards to the environment.

MR. VAN LAANEN: You may get into this if you get a vigorous enforcement of the NEPA requirements, but I don't know if that will be or not.

MR. STEIN: Thank you.

May we have Ted MacDonald?

STATEMENT OF TED MacDONALD, WEST LAFAYETTE, INDIANA

MR. MacDONALD: Mr. Stein, and gentlemen of the conference. My name is Ted MacDonald. My home is in West Lafayette, Indiana. I also own property on Lake Michigan immediately adjacent to the Donald C. Cook Plant at Bridgman. I am involved in a lawsuit at the present time against the Indiana and Michigan Electric Company in company with eight of my neighbors to recover erosion damages that have been caused by the construction of their plant.

But I speak to you today as a private citizen interested in preserving Lake Michigan. I speak not only for myself but for dozens of people I know personally from all four States bordering the lake and uncounted hundreds of thousands I will never know, all of whom will need a living Lake Michigan in the years to come, a living lake to provide them with peace-preserving recreation, the fresh water they need to survive, and perhaps an essential food supply in an overcrowded world.

And as I speak, I continue to be amazed that after all that has transpired, a few private citizens still must take it upon themselves to carry on such a major portion of the fight to save the lake -- and it is a real fight. I have the financial scars and a depleted supply of midnight oil to prove it. The people I speak for -- and I am in close contact with them -- feel there are some questions which need answering. Some positive answers to these questions must be found before further possibly lethal doses of hot water and radioactive waste are allowed to be administered to Lake Michigan.

MR. STEIN: Mr. MacDonald, just a moment, please.

I would appreciate it if the people would not talk in the back so the rest of the people could hear. Thank you.

MR. MacDONALD: First question: Why do power companies regard the granting of construction permits and operating licenses as a foregone conclusion? What would lead them to believe that they are safe in spending many thousands, yes, even millions of dollars, on preconstruction work before the necessary permits are issued? They seem so sure of themselves that it makes one wonder. Just one example of many: At Michigan City, a powerplant discharge flume is already partially constructed but the permit to complete it has not yet been approved.

Second question: Last March 30 at Grand Rapids, Michigan, Senator Philip Hart conducted a hearing for the Subcommittee on Energy, Natural Resources and the Environment of the Committee on Commerce of the United States Senate. At this hearing, Senator Hart questioned a top official of one of the power companies with regard to comparative costs of wet and dry cooling towers. The power company official replied, and I quote, "Let me say there are no nonevaporative cooling towers in the United States. The only experiment we are knowledgeable of in the foreign countries have not proven very successful as yet. These are under study by us but there needs to be a lot of development before they can be used."

Whereupon, an official of the Federal Power Commission stood up, identified himself, and reminded the gentleman from the power company that a nonevaporative cooling tower is now being installed in the State of Wyoming by the Black Hills Power and Light Company. Now, the question is this: Are power company officials as pitifully ignorant of the problems they are creating and the solutions to those problems as the foregoing example indicates, or do they tend to play Mickey Mouse with the truth when it is to their advantage?

Third question: When are State and Federal agencies which have power to grant power companies various permits and licenses going to get down to business and protect public interests? At the Donald C. Cook plant in Michigan permits for the intake outlet structures were all set for automatic approval until the facts came out at a hearing held only because of public demand. As a result, complete redesign of the structures was necessary. Why did the public have to hire consultants and attorneys to show government officials they were playing brinksmanship with the public interest? How many other permits already granted should be reexamined in the light of this incriminating example?

Fourth question: Why does the power industry continue to spend millions of dollars on advertising to sell more electricity, while at the same time broadcasting the dangers of impending power shortages? A TV news program tells the story of the recent brownout in the East. The sponsor of the show is a power company, and the commercial urges us to heat our homes electrically. How ridiculous can this comedy of errors become? Who can attach any credibility to statements from people in the electric power business when they so grossly underestimate the public intelligence and so poorly manage their business affairs?

Fifth question: When is the power to grant permits and licenses going to be shifted to State and Federal Government agencies which have some power to enforce such conditions and stipulations as the permits or licenses may contain? Such conditions and stipulations are usually in the public interest, but it has been my personal experience that it is up to the public to spend a bundle of its own nontax deductible dollars to do the enforcing.

Sixth question: Why do government agencies, particularly at the State level -- although I've seen the Army Corps of Engineers do it, too -- rely so heavily on people hired by the power companies for scientific information pertinent to the life or death of Lake Michigan? Here again it has largely been left up to the private citizens to bring forth and pay for their own reputable scientists to emphasize the obvious and proven fact that there are two sides to the story. I submit that John Q. Public is fed up to his ears with officials who have abdicated their responsibility to the people by swallowing the power company story hook, line, sinker, and contaminated bait.

In conclusion, I submit that the public is not to be underestimated in its determination, or in its knowledge of the many facets of this problem. The public wants answers to their perfectly legitimate and logical questions, only a few of which I have mentioned.

If the money already spent on this fight had been devoted to research to find answers to problems which already were there when the whole thing started, all of us could be attending to other important business today. Let me suggest that we stop wasting each other's time and money and get down to the business of finding ways to satisfy our power needs without destroying any irreplaceable natural resources in the process.

I am grateful for this opportunity to speak. Thank you very much. (Applause)

MR. STEIN: Thank you, Mr. MacDonald.

Any questions?

MR. DOWD: I have one question, Mr. Chairman.

While you are coming up with your question, I have to do my research in this room every day, and I forget it from one time to the next, but it always works. May I suggest that people who want to talk or hold conferences get outside that exit door. For some reason or another when you speak against that rear wall there in the next room, it is like an echo chamber, and your voices come right back up here, and there are some dead spots in the center where you can't hear it, but the noise level up here is rather loud. We have a lot of ante rooms available for private conversations and caucuses just outside.

Thank you.

MR. DOWD: I am Joseph Dowd, counsel for Indiana-Michigan Electric Company.

Mr. MacDonald, you mentioned that a dry cooling tower is presently under construction at a plant owned by the Black Hills Power Company. Do you know what the generating capacity of that plant is?

MR. MacDONALD: No, sir, I don't. It is on page 75 of that booklet you have in your hand.

MR. DOWD: Does it specify the generating capacity?

MR. MacDONALD: No, it does not.

MR. DOWD: Well, that is what I was interested in.

MR. STEIN: Are there any further questions or comments?

If not, thank you very much.

MR. MacDONALD: Thank you.

MR. STEIN: M. A. McWhinnie.

While you are coming up, Miss McWhinnie, I do have a clarifying statement from Mr. Sol Burstein, Senior Vice President of Wisconsin Electric Power, which I would like to put in the record. Some of you may recall we had a colloquy on the meaning of a quote from the Senate Appropriations Committee -- and I guess I started this -- and I think Mr. Burstein has clarified it. There was a typographical error in his report which led to my questions and they used the word "Commission." "Commission" was inadvertently substituted for the word "Committee," which makes the thing fairly clear, and we will place this in the record because I think this is explanatory.

(The letter above referred to follows on page 2159.)

MR. STEIN: And I also have a letter from John C. Berghoff, addressed to Mr. Klassen which, without objection, can be put into the record as if read in toto.

(The letter above referred to follows on pages 2160-2163.)

Wisconsin Electric POWER COMPANY
231 WEST MICHIGAN, MILWAUKEE, WISCONSIN 53201

October 1, 1970

Mr. Murray Stein
Chairman
Lake Michigan Conference
Sherman House
Chicago, Illinois

Dear Mr. Stein:

At the conclusion of the presentation of my prepared statement at the workshop session of the Lake Michigan Conference on Wednesday, September 30, you asked for a clarification relating to the quotation of the Senate Appropriations Committee, which begins on page 15 of my statement and concludes on page 16.

As you may recall, the question arose because of the word "commission," which appears in the first line of page 16.

The statement has been checked, and I find that the word "Commission" was inadvertently substituted for the word "Committee." The rest of the quotation is correct and is taken from the Committee's report on FY 1971 funds covering appropriations for public works for water pollution control and power development and the Atomic Energy Commission.

Therefore, the statement does indeed represent the thinking of the U. S. Senate Appropriations Committee, in response to your question.

Sincerely,

Sol Burstein

Sol Burstein
Senior Vice President

JOHN C. BERGHOFF
ATTORNEY AT LAW
115 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

TELEPHONE: (312) 431-2622

RECEIVED
SEP 29 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

September 28, 1970

Mr. C. W. Klassen, Director
Environmental Protection Agency
State of Illinois
535 W. Jefferson Street
Springfield, Illinois 62706

Dear Mr. Klassen:

LAKE MICHIGAN FOUR-STATE CONFERENCE

Thank you for your letter of September 22 with respect to the reconvening of the Lake Michigan Four-State Conference September 28 on the subject of Thermal Discharges.

Please accept this letter as a request for permission to present a brief oral statement at this conference, which I understand will be held at the Sherman House Hotel in Chicago, Illinois, on Friday, October 2, 1970. We appreciate the opportunity to make a statement in the public interest at this important hearing.

With kind regards.

Very truly yours,

J. C. Berghoff

John C. Berghoff

JCB:hk

STATEMENT OF JOHN C. BERGHOFF
FOUR-STATE CONFERENCE
THERMAL POLLUTION STANDARDS
CHICAGO, ILLINOIS - OCTOBER 2, 1970

My name is John C. Berghoff. I earn my living as Associate General Counsel of Swift & Company. I have spent most of my years living near the shoreline of Lake Michigan in Illinois, Indiana and Michigan. I am a member of the Council of the Illinois State Bar Association Section on Environmental Control Law. Today's statement I make, however, in my individual capacity as a person who greatly values the natural resources of this area, particularly Lake Michigan, and who wants to see these resources and this lake preserved for the youth of this generation and for generations to come.

I have no quarrel whatsoever with the nation's need for more electrical energy nor with the concept of nuclear plants to provide this additional energy. I do strongly object to the way in which the power companies are being permitted to use the nation's natural resources such as Lake Michigan as private industrial waste ponds.

The nuclear plant now under construction with which I am most familiar is the one being built on the lake shore at Bridgman, Michigan - the Donald C. Cook Plant. This plant will, when completed and if permitted to do so, draw two billion gallons of fresh, cold, Lake Michigan water each day, use it as a coolant in its nuclear processing and spew it back into the lake at the end of the day some 20 to 25 degrees warmer than when it was withdrawn. The American Electric Power Company which has announced that this plant will cost 400 million dollars is not planning to spend one single dollar to moderate this extreme elevation of temperature, nor for that part is it planning to spend one single dollar to assure zero or near-zero radioactivity of the water which will be returned to the lake. It simply, if permitted to do so, will treat Lake Michigan as its own private waste pond.

I strongly feel that the interests of this nation, and more particularly of the people who live in these four states which form the shoreline of Lake Michigan, deserve to have this natural resource protected by reasonable thermal pollution criteria adopted by the federal and state governments involved.

Further, it is my personal view that the top managements of the electric power companies involved, despite the great number of highly-qualified and highly-paid expert witnesses whom they have presented at this hearing, would welcome the promulgation of tough and uniformly enforced thermal standards. Under our free enterprise system, these companies cannot be expected to take the lead in protecting the public interest when it clashes with the private interests of their shareholders. Once a determination has been made as to what reasonable thermal standards are required to protect the public interest, however, and once the appropriate governmental agencies have adopted these standards, I am sure we will find the power companies conducting themselves as good citizens in compliance therewith.

I urge it to be the responsibility of each of the four states here involved and of the Federal Government to adopt meaningful, unambiguous thermal pollution standards, avoiding intricate mixing zone formulations which will only lead to costly compliance problems and will not give the nation and its citizens what is required to preserve these resources. You will best serve the interests of the conservationists and, though they may not admit it, the power companies as well, by adopting and enforcing uncomplicated, reasonable but firm thermal standards - you will have met the nation's need for expanding electrical energy without permitting our national resources to be ravaged in the process.

MR. STEIN: Would you go ahead?

STATEMENT OF MARY ALICE McWHINNIE, PROFESSOR, DEPARTMENT OF BIOLOGICAL SCIENCES, DePAUL UNIVERSITY, CHICAGO, ILLINOIS

DR. McWHINNIE: I am Mary Alice McWhinnie, Professor in the Department of Biological Sciences at DePaul University, with an earned doctorate from Northwestern University, and Director of the DePaul-EPRO Ecological Study of Lake Michigan. My credentials for speaking to this board of conferees relates to my professional experience in crustacean biology in study of effects of temperature changes on invertebrate animals in freshwater and Antarctic marine water, and to the work in which we are engaged on Lake Michigan.

Mr. Chairman, and conferees, ladies and gentlemen. I am grateful for this opportunity to present some views and concerns which I share with most, if not all, present at this workshop. I am aware of the serious responsibility each of us accepts in such participation, because of the unprecedented external pressure against nuclear-powered electric generating stations which pervades into an area of knowledge in which we find ourselves lacking in sufficient information to answer satisfactorily all of the questions placed by the non-scientist. I offer that the disparity of views presented thus far at this workshop attests to the inescapable reality with which we are faced: 1) the necessity and commitment to protect the environment; 2) the increases in population density; 3) the continuing demands for available energy; 4) the intolerable slowness with which definitive knowledge accumulates.

Though disparities clearly exist, as judged from the statements made at this workshop and elsewhere, there is within these multiple views (at least) one point of common agreement: more study is needed and the differences in existing and/or planned electric generating plant sites require individual study.

I should like to focus on what I believe led to the development of workshops of this kind, but I will not burden this statement with repetition of the long litany of data available on the topic of thermal modification. Rather will I include for the record statements prepared for the recent hearing conducted by the Illinois Pollution Control Board held in this city 25-26 September 1970. With the approval of the following authors, I ask to have entered the statements of Dr. Philip F. Gustafson -- who I understand presented his yesterday -- Director of the Great Lakes Program, Argonne National Laboratory (See Pp. 2179-2190); Dr. Charles Collinson, Head, Sedimentology Division, Illinois Geological Survey (See Pp. 2191-2201); Mr. John D. Harper, Director, Environmental Parameters Research Organization (EPRO) (See Pp. 2202-2209); and my own, as Director of the DePaul-EPRO Ecological Study of Lake Michigan (See Pp. 2210-2219).

The objective of Dr. Gustafson's presentation on "Thermal Discharges and Lake Michigan," is to illuminate the facts of natural thermal increments as they relate to man-induced thermal increments in Lake Michigan water. He states that the volume of water which would be involved in the operation of six nuclear powerplants to be in operation by 1978 "... tends to stagger the imagination and perhaps to blur reason." In recognizing the wide variation in Lake Michigan water temperature, seasonally and vertically, he questions the real meaning, and points to the ambiguity of the term "ambient temperature."

Considering the long period of operation of fossil-fuel plants at Waukegan, State Line, and Oak Creek, he notes the lack of any profound impact on the aquatic environment especially when compared with sewage and chemical waste outfalls. With respect to temperature, he shows a river water inflow to the lake which is at a temperature 5 degrees to 19 degrees Fahrenheit greater than the lake, and that this is near or comparable to the thermal input to the lake from a given nuclear powerplant; yet the former is not generally considered as "thermal pollution." The advantages and the disadvantages of the alternates to once-through cooling water are discussed and a "field program to determine best options" is urged; without this "... we will never know what reasonable thermal standards are ...." Dr. Gustafson recommends, in conclusion, that a plan be developed to allow present and near-ready facilities to operate to allow for the conduct of sound scientific investigations.

Dr. Collinson laid emphasis upon the scant evidence available concerning the sedimentary and chemical composition of Lake Michigan and that data must be gained before its original character is degraded. He points out that localized areas already give evidence of change, e.g., the oxygen demand of southern Lake Michigan sediments is approximately three-fold that of Lake Huron. A program to study unconsolidated sediments with respect to atmospheric dispersal and surface water pollution as indicated by trace metal accumulation was started in 1969. From the data thus far obtained, heavy metals appear to be accumulating (10 to something more than 90 p.p.m.) as is organic carbon. These two categories are directly correlated and may indicate that sediments with a high organic content may in time have a high metal content; changes should be closely monitored. Sediment type distribution and stratigraphy are also being studied. The main impression of their study is: "... a very serious absence of basic scientific data about Lake Michigan ...". "Reservations are held about the effectiveness and correctness of any blanket temperature standard ... at the present time." If a thermal input is allowed the site should be thoroughly studied before, and monitored after operation. "In final analysis ... our knowledge is so small ... and the resource so valuable ... we would welcome the exclusion of any input ... to the lake ...."

The thrust of Mr. John Harper's statement is that a mutually agreed upon moratorium be struck by the utility companies and the regulatory agencies. Such a moratorium would allow adequate study of completed or in-construction powerplants which would serve as the field experiments whose results would lay to rest the continuing debate prevailing in the absence of definitive information. He further states that under such a plan, power companies must be prepared to change their cooling methods if such is found to be necessary.

In my own statement, I presented the findings of several laboratories subsequent to study of "real situation" thermal modification of the aquatic environment, as well as in-laboratory duplications. In a number of such published studies no persistent biological alterations were demonstrated. Results were comparable for freshwater and marine organisms as would be expected of living systems. The temperature preferences of some plant and animal species were cited within this context. The implicit limitations of "fixed number policies" in establishing the maximum limits of thermal increments, or fixed distances for mixing zones, are presented just on the basis of the characteristics of a natural environment for which data were given. Based on those considerations, a position, finding agreement with most scientists, is taken that we can delay no longer in the procurement of hard data to provide the answers needed.

The full text of these four statements is presented as an appendix to this one.

Within the context of this workshop, I should like to present some reflections on what I consider to be the questions which lead to such, and for which we are seeking some reasonable solutions:

M. A. McWhinnie

1. What is the true nature of the problem, described to be a temperature increase in the Great Lakes in general and Lake Michigan in particular?

My own answer to this can be no different from that of all persons present. Briefly, it is a scientific question directed at the physical, chemical, and biological modifications that will result when one factor, in the complex web called "nature," is varied.

Many scientists have spoken on this subject and presented evidence that must be reckoned with, and some of that evidence has not corresponded with intuitive feelings expressed by others.

It is necessary to state that a tone or climate appears to have come to prevail in this workshop such that it might be more appropriately characterized under the title of a trial. In my opinion, it is unfortunate that by the second day of this week the words "testify," "witness," and "cross examination" became common language. My interpretation was placed in some doubt when on Wednesday it was stated that this meeting was to engage in a discussion; however, my first impression persisted. Information emerges from both types of activities but the former deals with an objective problem to which all seek solutions; the latter, however, leads to impugning motives and credibility.

M. A. McWhinnie

If science has nothing to say or to contribute to our environmental problems, then our solutions will be less than adequate; they shall have no more justification than expediency; objectivity becomes nonexistent, the scientist will return to his laboratory and our society will lose.

2. My second question could be called the first: From what source(s) can those convened here, and all Americans, holding diverse priorities, seek the information essential to reasonable decisions?

The answer must be those persons who, by virtue of an earlier academic preference, pursued study in depth of those disciplines called physics, chemistry, biology, meterology, geology, and engineering -- and the environment is all of these. These men have no special omniscience, but in their area of competence they have knowledge, experience, insights, and a deep curiosity to "know." If our judgment of their data is influenced by the "by-line" over which their name is given, and the persons to whom they speak in a civil society, we fly in the face of honesty, we discredit without evidence, and as a Nation we demonstrate a schizophrenic personality, seeking the benefits and by-products of science on the one hand as we discredit it on the other when it does not support a fear or uncertainty which we might interpret as fact.

If the proof of "no damage" to the environment rests upon the user, to whom can he turn for the proof? If he seeks those qualified by training, by research, and by objectivity, the latter are viewed with skepticism, if not discredited, and the former are said to be "fighting the issue."

Yet so recent as 29 September 1970, the "Chicago Sun Times" carried an article stating that Mr. Stein said, "... industry ... and not the public ... should prove that its projects pose no threat to the environment or public health." It is with deep concern over this conflict that I submit the view that Lake Michigan belongs to scientists, too.

With a high hope to obtain answers essential to the making of supportable decisions and acceptable to an irate public too quick to judge and too concerned to be silent, the DePaul-EPRO study was initiated in the field in June 1970; a multidisciplinary study conducted by a confederation of 10 scientists from private, public, and governmental agencies, responsible and concerned, as are the conferees and all participants here, to reach for answers proportionate to the urgency of the issue. Their data are only now beginning to accumulate but their motives have been publicly impugned; yet they stand independent of all vested interests, and this is well understood by all persons on both sides of this question.

Gentlemen of the board of conferees, if scientists are the only appropriate segment of our society to study the science-based issues of our environment, can they be written off because someone doubts their motives? If study of the environment is not really needed, why did a conferee ask this week, "... could any meaningful conclusions be drawn from a one-day study ..." as it was reported by one of the speakers?

If lack of study is not our critical problem why was the Kittrell report, for the FWPCA, of 1968, so thoroughly detailed as to what had to be done that we might "know"? Perhaps more critical is the problem that that study was not, to my knowledge, undertaken. Is that part of why the answers are not always forthcoming?

If this was not true would we have come to be impatient with what is increasingly called a wait-and-see policy? Is the character of that phrase intended to encapsulate the view of or paraphrase scientists? If so, I urge that we recognize that erroneousness is insidious, it is defeating; it is divisive in a society already fraught with doubts, suspicions, and credibility gaps.

M. A. McWhinnie

3. What will be the effect on the biota subsequent to thermal modification of Lake Michigan?

Throughout this workshop, highly qualified scientists have presented their own data and that published by others; similarly, biological data have been presented in the "white paper" of the Department of Interior. In my own statement of recent time, submitted herewith (See Pp. 2210-2219) and previously this year, I too have called upon the scientific literature. I think I shall add little to cite still more titles for the record.

I should like to add another consideration with respect to temperature effects on living systems. May I say first that the subtleties of the capacities of living systems are profound and exquisite and continue to amaze even those who have devoted their life to such studies. Many of these subtleties pervaded the answers which Dr. Raney offered to your questions. He, as well as others, could not concur with the view that plus 1°F., or plus 5°F., or plus 3°F., or plus anything had any significant meaning to organisms in a dynamic system, one changing from moment to moment to constant fluxes in the natural environment.

If some fixed value is the maximum permissible for cooling water entering the environment, such as plus 5°F., or other,

M. A. McWhinnie

a) Is this meaningful when it is 50° plus 5° in the same context as when it is 60° plus 5°, or 70° plus 5°?

In terms of ease of understanding for those unfamiliar with biological phenomena it may be. For living systems, and those who have some understanding of them, each condition is dynamically different as it slides along the temperature-response curve for each species and for each vital function for each species. As a consequence, such a regulation would have less than real meaning in the biosphere.

Indeed the living systems we work to protect pass through such oscillations in a diurnal (daily) cycle, and more; further, those endemic to the waters we seek to conserve live through approximately 32.5°F. to approximately 80-85°F. on an annual cycle. Dr. Raney's comments on the yellow perch which have a range from the southern States to these latitudes are the biological evidence of the range of tolerance and adjustment. I hold this point as valid, even in the light of others made by the authors of the "white paper." Given the opportunity to discuss this in depth, I believe we would not find those two views so diverse; but the requirement of "yes" and "no" answers obscures biological realities and creates an erroneous polarity.

M. A. McWhinnie

Delicately shifting biological phenomena cannot fit into "legal boxes."

In this context, and all the nuances that it implies, what meaning does a fixed thermal increment have?

b) If plus 5°F., or other, is a fixed limit for natural water resources, is it for any water--water relatively free of high concentrations of naturally-occurring elements (phosphorus, nitrogen, silicon, calcium, etc.); or water with some given concentration of these; or water deteriorated with chemical waste, with toxic compounds, with phenols, cyanide, acid waste? No single environmental factor can have an uncomplemented effect. How will a fixed thermal increment cope with the phenomenon of synergism?

May I note that Dr. Pritchard stated that temperature does not cause eutrophication; rather do inorganic, and organic nutrients. The verification of this may be evident when in late August at these latitudes, an algal bloom of enriched waters in summer declines, while yet the temperature is high or higher than previously. The decline in algal growth occurring at elevated temperatures corresponds with the decline in nutrient due to massive utilization. As the temperature then declines naturally into fall, another algal bloom occurs in October as a result of a new rise in nutrient and yet the temperature is lower.

M. A. McWhinnie

Is it then temperature which causes eutrophication; and what does a fixed thermal increment mean in this context?

I have another concern, and it is with reluctance that I note it, for it is "ticky-tacky," and it could be subject to disproportionate criticism. Under other circumstances, I would not speak to it, but as I noted earlier, erroneousness is defeating and only for that reason shall I mention it. In the now well known "white paper," three references cite the periodical, "Chesapeake Science." Volume 10, Numbers 3-4 (1969) of that periodical was devoted to the studies which were reported at the Second Thermal Workshop of the U. S. International Biological Program, and 29 papers were given. Of the three references to this periodical in the "white paper," one was to the introductory opening remarks to the workshop, and another was to a resumé. I wonder why some of the data presented in the other 28 of those papers did not find their way into the "white paper"? I ask this question because some of the data which I cited which show no thermal effect were taken from that same volume and number(s).

In conclusion, may I say the problem we are discussing is, in my judgment, scientific; it is complex in the extreme; it cannot be resolved by debate; it must not be confused with intuitive feelings; and, it shall not be resolved if scientists leave the world of contemporary problems in our society.

Rarely does the opportunity arise to attest to your convictions and defend your profession in order to serve the society and civilization of which you are a part. I am grateful that you have made this possible. Thank you.

(The papers cited in Dr. McWhinnie's presentation follow in their entirety.)

Thermal Discharges and Lake Michigan

P. F. Gustafson
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Argonne, Illinois

At the present time the states bordering upon Lake Michigan and the federal government are wrestling with the questions raised by discharging waste heat into the Lake. The deliberate release of waste waters at temperatures above that of the Lake at the point of input is not a new practice; it has been part and parcel of human occupation of the land along the Lake and has increased at a rate commensurate to or exceeding that of population growth. What is new, however, is the fact that the wisdom of this practice is now being questioned, and indeed being subject to regulation by the appropriate agencies. This questioning and probing is a healthy sign, a further indication of the awareness on the part of a growing number of citizens that our resources are not endless; that the natural environment - be it air, land, or water - does not have a limitless capacity to absorb wastes and other forms of insult and assault.

The matter of thermal discharges into Lake Michigan has been brought to the fore by the construction of six large nuclear power plants (a total of ten individual reactors to be in operation by 1978) which intend to use Lake Michigan water for condenser cooling, and discharging this water directly back into the Lake. The sheer magnitude (volume) of water involved, coupled with the rise in temperature over the condenser, tends to stagger the imagination and perhaps to blur reason.

About 4,600,000 gallons per minute (gpm) or 10,000 cubic feet per second (cfs) will be required for cooling purposes by the nuclear plants now under construction. This figure does not include the Bailly nuclear unit now being considered. The cooling water will gain an average of 20.5°F across the condenser. Cooling water for the nuclear plants will be taken from some distance off-shore, and in most cases from near the Lake bottom. Hence, the cooling water will usually be below the ambient temperature of the surface waters when it enters the plant, and as a result the temperature difference between discharge water and lake surface temperature will be significantly less than the ΔT across the condenser. The objective of this statement is to attempt to place the cooling water discharged from nuclear power plants in a reasonable perspective, to discuss what is known and what is unknown concerning thermal parameters in Lake Michigan, to explore the alternatives to direct Lake discharge, and finally, to suggest a course of action to answer pertinent scientific questions, to alleviate economic and operational stress, and to provide adequate electric power to residents of the Lake Michigan region.

Perspective

Lake Michigan is the fifth largest body of freshwater in the world. It is of sufficient depth that it is thermally stratified during the summer (roughly May to November), and is thermally mixed from top to bottom each spring and fall. The primary source of heating of the Lake is direct solar and atmospheric radiation, with river and surface water run-off providing a relatively minor additional natural heat input to the Lake proper. Major man-made sources of warm water discharges include industrial discharges, municipal sewage treatment plant effluent, and cooling water from steam generating facilities. The waste heat from this latter category is most readily documented because of the rather direct relationship between electrical output and heat loss across the condenser. In addition, detailed records of power generation make it possible to determine not only annual heat discharge but to break it down into daily or even hourly segments. The present electrical generating capacity situated on Lake Michigan, and using Lake water for cooling, is about 8000 MWe.* Except for 75 MWe which comes from the Big Rock Nuclear Plant at Charlevoix, Michigan, all this power comes from coal- or oil-burning plants. Older fossil fuel plants such as these have an efficiency of about 30-35% (although fossil fuel plants built recently achieve about 40% efficiency) for converting heat into electrical energy. Of the 65-70% waste energy as it were, about 15% is lost up the stack. Thus, from the 8000 MWe from fossil fueled power generation, there is between 17,000 and 19,000 MW of waste heat produced, of which 13,000 to 15,000 MW is released to the condenser cooling water. The present type of nuclear power reactors have a conversion efficiency of about 33% (heat to electrical energy), and effectively (a few percent may be lost directly to the atmosphere in the plant) all of the waste heat (67%) is released to water across the condenser system. Therefore, we see that for each unit of electricity actually generated (per kilowatt, for example), 20-35% more heat (50% more when compared to the most modern fossil plants) is discharged to cooling water from a nuclear plant than from a conventional fossil-fuel installation. It is also true that the present trend in power plant construction is in terms of blocks of 500 to 1000 MWe per generating unit. This means that the heat released is concentrated in a localized area, and is somewhat more aggrevated in the case of nuclear plants because of the greater aqueous heat loss per unit of power produced as discussed above.

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*8000 megawatts electrical, a term describing generating capacity.

In terms of heating of the entire Lake, the discharge from generating plants makes an insignificant input. Calculations show that if none of the heat from present power plants and those proposed through 1978 were to leave the Lake over an annual cycle, the temperature increase would be a few hundredths of a degree centigrade throughout the entire Lake. Of course, such a situation does not exist in nature, as there is continual heat loss to the atmosphere by evaporation and non-evaporative processes. It is also true that the discrete thermal discharges from power plants do not mix throughout the entire Lake, but are essentially localized entities of warm water. It is because of this phenomenon of relatively restricted volumes of warm water, present in one general location near shore, that raises questions about biological effects and other aspects relating to water quality.

Except at times during fall and spring when the Lake is thermally mixed, the temperature is not uniform throughout the Lake. In summer, the mixed surface layer (which may extend down to depths of 60-70 feet) is appreciably warmer (10-25°F) than the underlying waters. Conversely, in the winter, surface waters may actually be colder than those at greater depths. Furthermore, there are variations in surface water temperatures over fairly short distances (less than a mile) and/or short time intervals (less than an hour). These variations are particularly evident near the shore, and are due to the upwelling of cooler water, warm surface water being blown onto the shore, and other wind and current phenomena. These variations make the term ambient temperature somewhat ambiguous other than in a general or average sense.

As mentioned earlier, there are already a number of generating plants situated on Lake Michigan which draw cooling water from the Lake and return the heated effluent to the Lake. Three of these begin to approximate the generating capacity and thermal discharge of the nuclear stations now under construction. These larger plants now in operation are Waukegan (1108 MWe), Oak Creek (1670 MWe), and State Line (964 MWe). A feeling for the magnitude and the environmental effects of thermal discharges may be obtained by looking at and around these plants which have been in operation for a number of years. The initial impression is that these plants have not had a very profound or obvious effect on the Lake, certainly not an adverse effect as appears to have been the case with some other discharges such as sewage and chemical discharges. Determinations of the lateral extent and the depth of the warm water discharges (called thermal plumes in analogy to smoke plumes) have been made by infra-red over-flight techniques and by making direct temperature measurements in the water. A thermal discharge is warmer than ambient Lake water and tends to float because it is less dense, spreading out as it floats in a manner dictated by wind, current, and the velocity of the discharge itself. The Lake thermal plumes studied are a few feet (6-8 maximum) thick and have temperatures which are measurable above ambient (about 1°C) out to a mile or so from the discharge point. The initial decrease in water temperature from the outfall to the measurable edge of the plume occurs primarily through mixing with the cooler water surrounding the plume, with some loss directly to the atmosphere as well. Over a matter of a day or so the bulk of the heat is lost to the atmosphere. Other than providing a warmer region for swimming, and a more ice-free region of limited extent during the winter, and occasional periods of local fog, there are no obvious physical effects from the thermal discharge. Biological effects are equally hard to discern. Fish are noted to congregate near the outfall, particularly in winter-time, but increased algal blooms, differences (or lack of) in bottom organisms and other indications of biological change have not been documented. Bottom organisms probably are not truly good indicators of the thermal situation because of the surface-floating character of the warm water. The fact that changes have not been documented in part implies they are difficult to see, or are slight if not non-existant. On the other hand, it must be said that not a great deal of research has been devoted to looking for thermally-induced changes. So we are faced with a situation in which obvious changes have not been observed, but secondary, more subtle, effects at some distance from the point of input may take place.

Additional information as to possible thermal effects can be obtained from examining stream and river plumes in the Lake. The prime example as far as Lake Michigan is concerned is the Grand River which has an average flow of between 1500 and 7700 cfs depending upon the time of year. This compares with the flow rates of 3260 and 3500 cfs specified for the Zion and Donald C. Cook plants, respectively. The Grand River is also warmer than the average surface temperature of the Lake, varying from 5°F above Lake surface temperature in March and September to as much as 19°F in July. During part of the year the actual heat carried into the Lake by the Grand River in BTU/day, for example, closely approximates that which would be released from the largest nuclear plants now under construction on the Lake. From March through July the Grand River dumps between 200 and 340 billion BTU/day into the Lake, whereas if run at peak capacity for 24 hours a day the Donald C. Cook and Zion plants would discharge 390 and 340 billion BTU/day, respectively. It is interesting to observe that the Grand River is not generally thought of as a source of thermal pollution.

Alternatives

On the basis that adverse effects may be taking place now from the presence of thermal inputs or the mode of introduction, or that such changes may occur if the inputs increase, one must consider other means of disposing of waste heat. This can be done in several ways; through increased volume of cooling water, diffuser systems which increase mixing, cooling ponds, cooling towers, or combinations of these. It is also apparent that in the main, the summer months are the more critical time; hence, the time when more elaborate cooling measures should be taken. There is, of course, a further option open and that is to not site power plants or other heat sources along the Lake at all. This is a solution for future siting, but hardly helps in present circumstances. From a strict economic sense, direct cooling is least expensive in terms of initial investment and annual operating costs. It may, in fact, turn out in the end to be the most reasonable use of a natural resource, namely the Great Lakes.

Each of the various alternatives will be considered in terms of their advantages and disadvantages.

1. The condenser discharge could be mixed with additional water before entering the Lake. This would serve to reduce the difference in temperature

between the plant discharge and the Lake itself; however, it would not reduce the total heat input to the Lake. Such a procedure involves the expenditure of energy in pumping, and the larger volume of relatively high velocity water might produce both physical and biological effects such as scouring of the Lake bottom, or influencing fish movements. The advantage would be that modifications to present facilities could be done at or near the Lake shore in most instances, and would not require the use of additional land.

2. Diffuser systems. Multiple nozzle or aspirator systems will allow rapid mixing with cooler surrounding water, and when spray devices are used, direct heat loss by evaporation is achieved. Such systems will represent some expense, and the durability and maintenance of such devices has not been field tested on a large scale. Where actual sprays are involved the water loss from the Lake system will increase due to evaporation.

3. Cooling ponds. These would require considerable land adjacent to the plant to be used for this purpose - approximately two acres per MWe is a rough figure for cooling pond size. The loss of water from evaporation would be comparable to or somewhat greater than if the heat were put directly into the Lake itself. Confined bodies of warm water such as this may become algal beds, and require attention to prevent their being a source of odors. The quality of cooling pond water will decrease with time as solids left behind by evaporation accumulate.

4. Cooling towers. Wet or dry cooling towers for power plants in the 500-1000 MWe range represent a sizable capital investment. The Davis-Besse Plant in Ohio is spending $9,000,000 on cooling towers for a 872 MWe facility. They will also consume power in their operation, and require periodic maintenance.

Such towers are fairly large in size, both height and base area. Wet towers will be more wasteful of water in that they depend heavily upon evaporation for heat removal. Solids left behind in evaporation must be removed, as must slime and algal growths, usually by back-flushing into the Lake. Such a procedure will produce periodic inputs of concentrated chemicals into the Lake. The evaporation may lead to fog and icing under appropriate meteorological conditions. Dry cooling towers do not waste water, but are limited in their cooling abilities by the ambient air temperature as cooling is done by exchange to the air passing over the cooling coils. Experience with dry towers is limited to fairly small (200-300 MWe) installations. In some locations, objections have been raised concerning the appearance of cooling towers and their effect on the landscape.

Combinations

A combination of methods might prove most acceptable in the long run. Direct discharge except in warm seasons, when cooling towers could be used, is one possibility. This would also avoid the fog and ice problem during the winter months. A cooling pond-direct discharge is also in this category.

It should be emphasized that from the standpoint of water conservation, direct discharge of heat in the Lake is most conservative of this resource. As demands for Lake water increase, the diversion of water for cooling towers and ponds may be regarded as an unacceptable use of water.

Field Program to Determine Best Options

Two things seem apparent: 1. That demonstrable physical and/or biological effects from present thermal discharges are hard to find on the Great Lakes or elsewhere. 2. There is a need for well-planned intensive and extensive field work to determine what effects, if any, do exist. It would also seem reasonable to not be overly restrictive on thermal discharges in light of present observations. In reality we will never know what reasonable thermal standards are until adequate field work is done, and to do this it will be necessary to have thermal discharges to study. Otherwise an unwise alternate, the consequences of which are, in fact, less clearly understood, may be chosen. There are environmental costs to be borne in any event, and what must be done is to minimize these costs in conjunction with their socio-economic impact. This should be the prime objective of regulation. There is a conservation principle involved here related to the conservation of energy principle. In fact, energy is the real culprit. Feasible methods of steam electrical generation are inherently limited to maximum efficiencies of the order of 40-50%. This means that half or more of the heat produced must be discarded, and the name of the game is to discard this heat in the manner least offensive to the environment or to use it beneficially in some manner. There is a feeling, based upon plenty of evidence to be sure, that whatever man does in terms of waste disposal is probably wrong. It is possible that in the case of heat, discharge to Lake Michigan is an appropriate, and acceptable use of a natural resource. It remains to be proven, however, and the natural capacity of the Lake to receive and to eliminate heat must be determined.

The source of support to do the necessary research is always a problem. But consider the manner in which monies are now being spent. For example, the Davis-Besse nuclear plant on Lake Erie is going to spend $9,000,000 on cooling towers, plus operating and maintenance expenses annually. This exceeds the total amount spent annually on research in the Great Lakes which is at all relevant to the pollution question, and greatly exceeds the annual support of thermal research on the Great Lakes. The point is that more money could be reasonably spent to determine whether or not cooling towers are a) necessary, and b) desirable, rather than going ahead and building them without further consideration. The money involved could go a long way toward answering some of the uncertainties, without irreversibly harming the Lakes, and perhaps would even save expenditures in the long run.

Lake Michigan Plan

A suggested plan for determining thermal effects and thermal capacity is to allow present facilities, and those under construction, to operate, but to conduct sound scientific investigations of the environmental effects of such operation. At present, theory is inadequate to predict the consequences; only experiments will do. This does not mean a license to operate indefinitely in the face of evidence of deleterious effects. If such effects manifest themselves, corrective action must be taken. Such a procedure could be conducted under a Lake Michigan Environmental Agreement between the public (through their representatives) on the one hand and thermal dischargees on the other. The results of field investigations should be reviewed by a Commission composed of federal, state, and local representatives, industrial representatives, and members of the concerned public such as conservation groups, environmental committees and the like. If the findings indicate environmental change, the Commission must make a judgment as to its seriousness and recommend that corrective action be taken promptly, and may even recommend what corrective action be taken. The details of this approach must, of course, be worked out. The main point is, however, that some reasonable course be followed which does not blindly trade one environmental situation for another which is even worse.

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TESTIMONY FOR THE ILLINOIS POLLUTION CONTROL BOARD

Field Museum Chicago, September 25 and 26

Thermal Standards for Lake Michigan

Charles Collinson
Illinois State Geological Survey,
Coordinator for Geological Research in Lake Michigan

The Illinois State Geological Survey has long had an interest in Lake Michigan, going back more than 75 years to the days of Leverett, whose works are still standard descriptions for the lake region, and extending up through the time of M. M. Leighton and J. Harlen Bretz, whose works bring us up to the present day. The Lake researches of those years were studies of the historical lake, however, and consisted mainly of descriptions of the physical aspects of the lake shores, the beach ridges, wave terraces and outlet drains. These studies have provided us with a knowledge of the history of the lake and with it an appreciation of the unique resource that the 13,000 year old glacial lake represents. On the other hand, such studies did not produce the kind of basic information our growing lakeshore population now requires.

Last year, in examining information sources about the living lake, our staff concluded that the lake sediments have received scant attention as far as sedimentary and chemical composition are concerned and that time is running out for the gathering of data before the original character of glacial Lake Michigan has been seriously degraded. Localized areas already are undergoing environmental changes--large populations of sludgeworms nourished by organic nutrients discharged into the lake have been found in bottom sediments along the perimeter of the southern half of the lake (Federal Water Pollution Control Administration, 1968, Lake Michigan Basin Report, physical and chemical quality conditions). In addition, surface water run-off, atmospheric fall-out and industrial discharges appear to have contributed significant amounts of chemical trace elements to the southern Lake Michigan Basin (Figure 1: Illinois State Geological Survey Environmental Geology Notes 30 and 32, 1970). The overall result is that the oxygen demand of the southern Lake Michigan sediments is about three times that of Lake Huron, indicating considerable organic enrichment (Benton, 1968, Univ. Wisconsin, Milwaukee, Contribution No. 7).

In response to the need for more information on these conditions, the State Geological Survey, in cooperation with Prof. Harry V. Leland of the University of Illinois Department of Civil Engineering, began an extensive examination of unconsolidated sediments in the southern lake basin. Sampling was begun in mid-year 1969 from research vessels of the University of Michigan Great Lakes Research Division and the Bureau of Commercial Fisheries. Later use was made of samples taken off Waukegan and Zion by Professors McWhinnie and Murphy from DePaul University, samples furnished by the Federal Water Pollution Control Administration, and samples taken from a private vessel.

The program has two objectives. Dr. Leland and his associates in the University are determining the extent of atmospheric dispersal and surface water pollution in the lake and particularly that which can be measured in terms of trace metal concentrations. In the analytical chemistry laboratories of the Geological Survey this study has been extended to include analyses for the major elements and minor constituents: aluminum, silicon, iron, calcium, magnesium, potassium, sodium, inorganic carbon, organic carbon, titanium, manganese, mercury, phosphorus and sulphur. Trace elements determined are boron, beryllium, bromine, cadmium, cobalt, chromium, copper, lanthanum, nickel, lead, scandium,

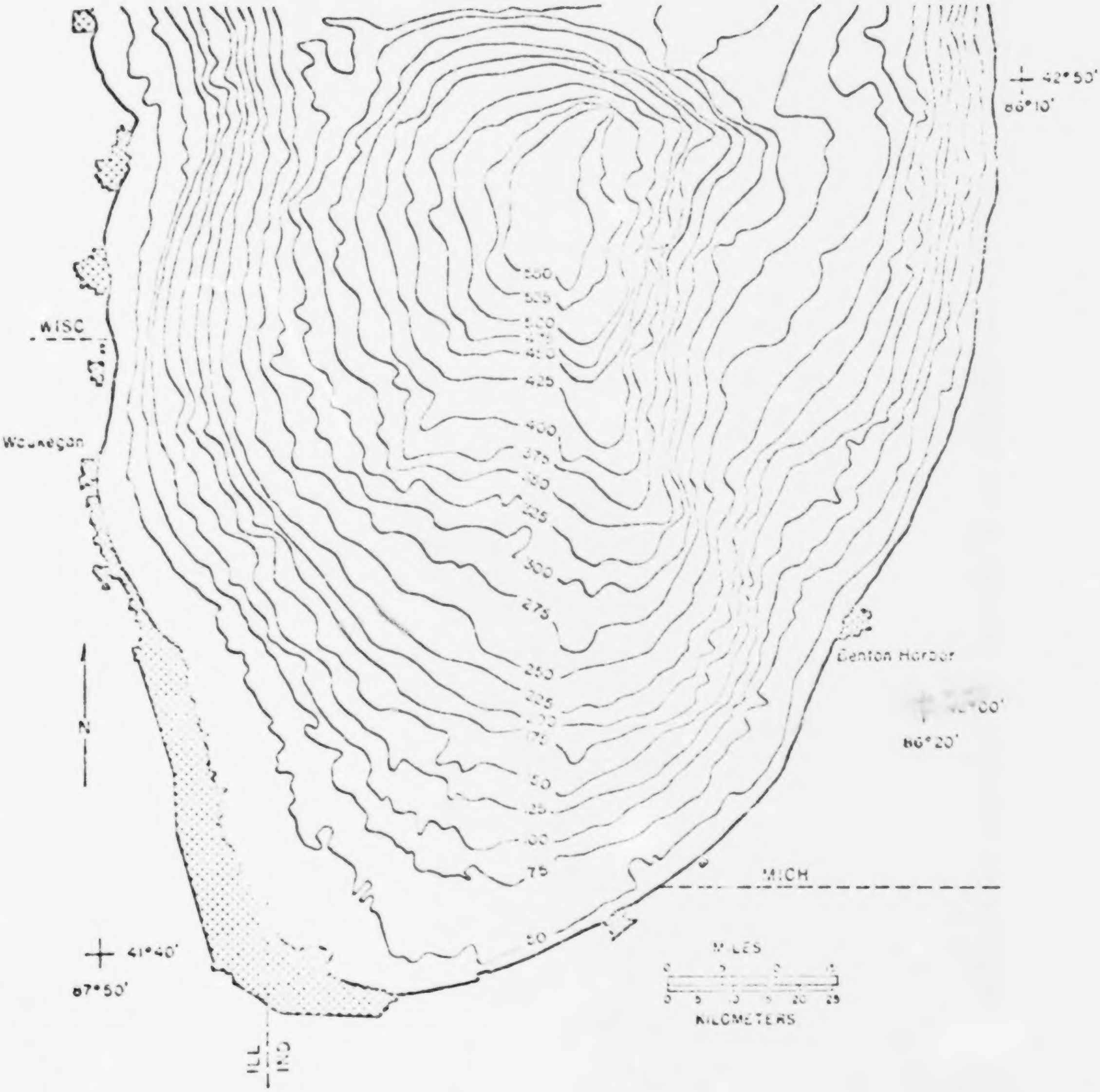

Fig. 1 - Topography of the lake floor, southern Lake Michigan. Contours represent depth in feet below mean low-water level (576.8 feet). Contouring is based on U.S. Army Corps of Engineers Lake Survey District charts.

Taken from Fig. 2, I.S.G.S. Envir. Geol. Note No. 30.

vanadium, zinc, arsenic and mercury.

In the clay analysis laboratories, the sample fraction of less than a micron size clay and the clay mineral composition are determined. Already one report, Illinois State Geological Survey Environmental Geology Note 32, has been produced on distribution of chemical constituents in the lake floor sediments.

Little has been known of the extent of accumulation of inorganic elements in the lake floor sediments, especially so for the toxic metals: lead, copper, chromium, cadmium, arsenic and mercury. This is where our chemical studies bear directly on the problem of standards for thermal input into Lake Michigan. These early stages of chemical research have shown (I.G.S. Environmental Geology Note 32, 1970) that lead, bromine, zinc, nickel, arsenic, mercury and chromium have accumulated and probably are still accumulating in the upper few centimeters of lake floor sediments. Concentrations, which reach levels ranging from 10 to more than 90 parts per million, correlate directly with the organic carbon content of the sediments and somewhat less directly with the less than 2 micron size clay fraction in the sediment (Figure 2). This fraction constitutes as much as 50% of the sediment in some areas of the lake floor. Thus it appears that sediments with high organic content in time will also be high in toxic metals.

Although it is speculative at this stage, because we do not know the source of the organic matter, the point to be made in this respect is that local increases in productivity of algae and other plankton due to local temperature increases could possibly cause concentrations of particulate organic carbon that might fix significant amounts of toxic elements. Where these occur in the shallow waters of the lake, they could be of serious concern.

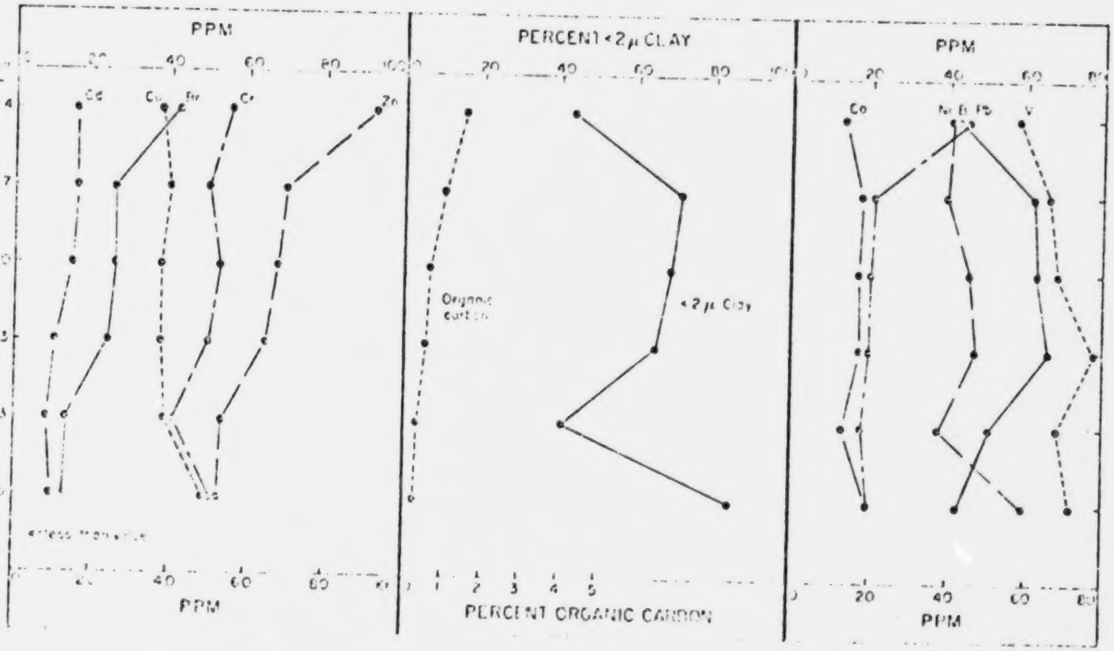

Fig. 2 - Distribution of trace elements, organic carbon, and <2 μ clay in Lake Michigan core No. 182.

Taken from Fig. 5, I.S.G.S. Environ. Geol. Note No. 32.

Additionally, inasmuch as we do not know the procedures whereby the metals become fixed by the sediments, we should closely follow any changes in the lake that might significantly increase the biomass and should study in detail the conditions existing before any thermal or other input is considered and then continuously monitor the area for signs of significant changes in water quality, plant and animal communities, and sediment composition.

Coequal with the geochemical studies of the Survey has been a comprehensive program for mapping sediments of the lake floor and describing the stratigraphic sequence, composition and thickness of sediments under the lake (Figures 3,4). The cores, which range from 3 to 20 feet in length, penetrate the soft lacustrine clays, sands and silts and occasionally encounter the underlying glacial till that occurs over most of the southern lake basin. These studies have provided great quantities of new data and unexpected discoveries. For example, the lacustrine units are of special interest in that their water content ranges between 90 and 200% of dry weight (Figure 5). In addition, they are thixotropic, that is without bearing strength when disturbed, but otherwise appearing solid. These sediments range up to 30 or 40 feet in thickness and cover more than a thousand square miles of lake floor. Their mineralogy, chemistry, age and stratigraphy are only now being detailed. Their role, if any, as reservoirs of sublake water should be taken into account in any lake water or heat budget.

In brief, the main impression gained from our studies is that there is a very serious absence of basic scientific data about Lake Michigan that must be gathered if we are to effectively achieve and maintain the good health and continued usefulness of the lake.

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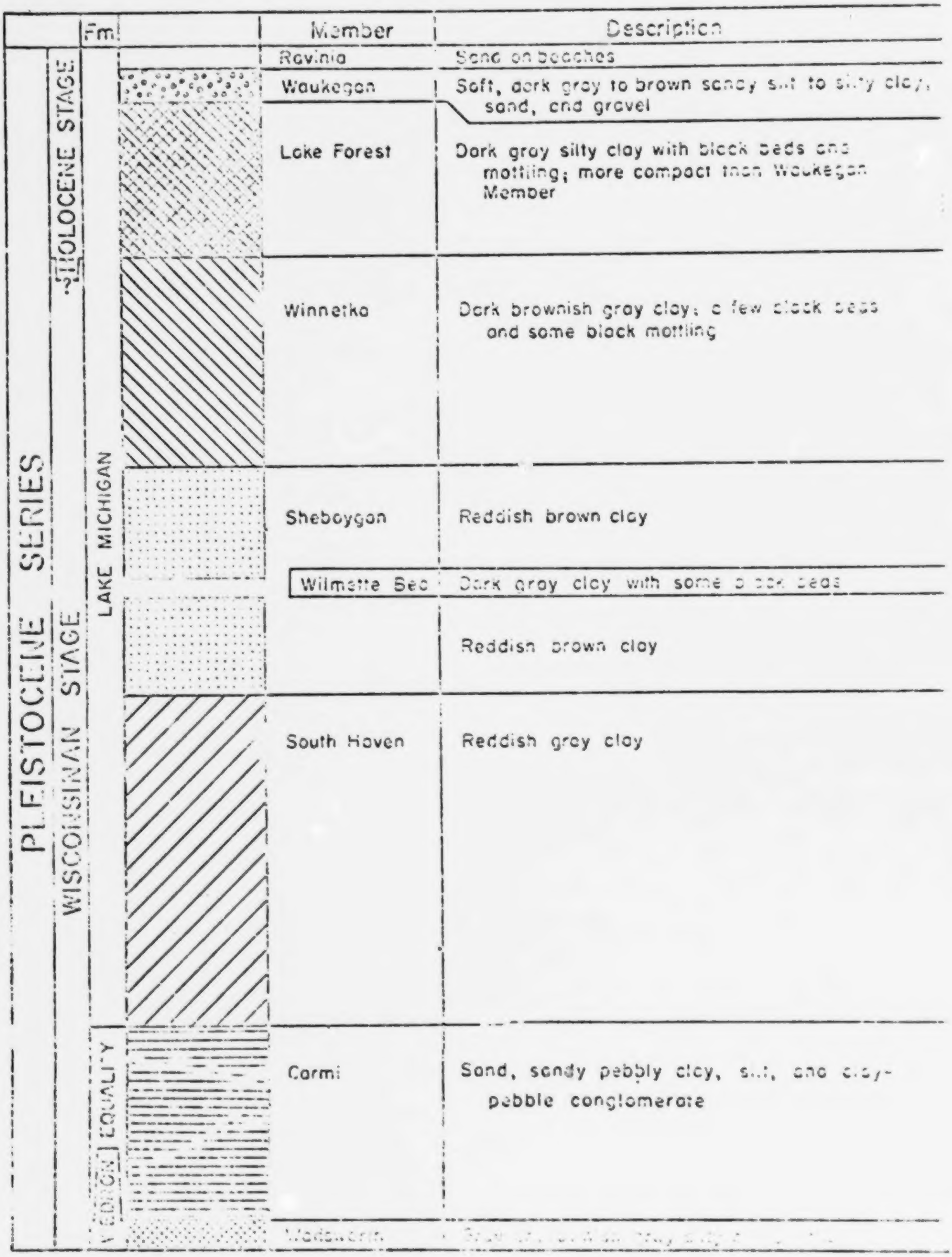


Member	Description
Ravinia	Sand on beaches
Waukegan	Soft, dark gray to brown sandy silt to silty clay, sand, and gravel
Lake Forest	Dark gray silty clay with black beds and mottling; more compact than Waukegan Member
Winnetka	Dark brownish gray clay; a few black beds and some black mottling
Sheboygan	Reddish brown clay
Wilmette Bed	Dark gray clay with some black beds
	Reddish brown clay
South Haven	Reddish gray clay
Carmi	Sand, sandy pebbly clay, silt, and clay-pebble conglomerate
Wadsworth	Gray to brownish gray silty [illegible]

Figure 3—Generalized stratigraphic column for unconsolidated late Pleistocene sediments underlying southern Lake Michigan.

Taken from Fig. 2, I.S.G.S. Environ. Geol. Note. No. 35.

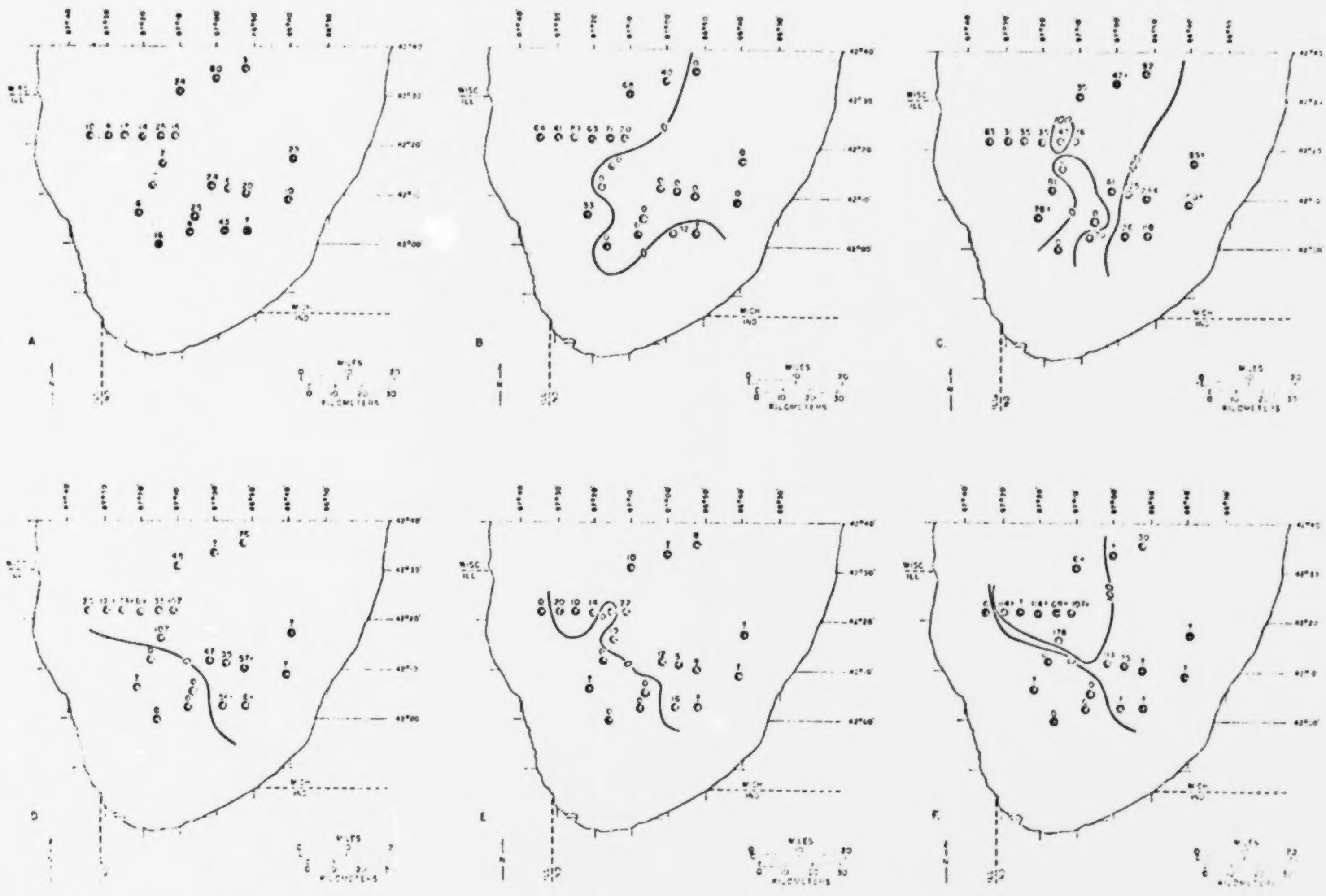


Fig. 4- [illegible] showing thickness (in cm) and distribution of units of the Lake Michigan Formation in southern Lake Michigan. A. Waukegan [illegible]; B. Lake Forest Member; C. Winnetka Member; D. Sheboygan Member (total); E. Wilmette Bed; F. South Haven Member.

Tak[illegible] C, I.S.G.S. Environ. Geol. Note No. 35.

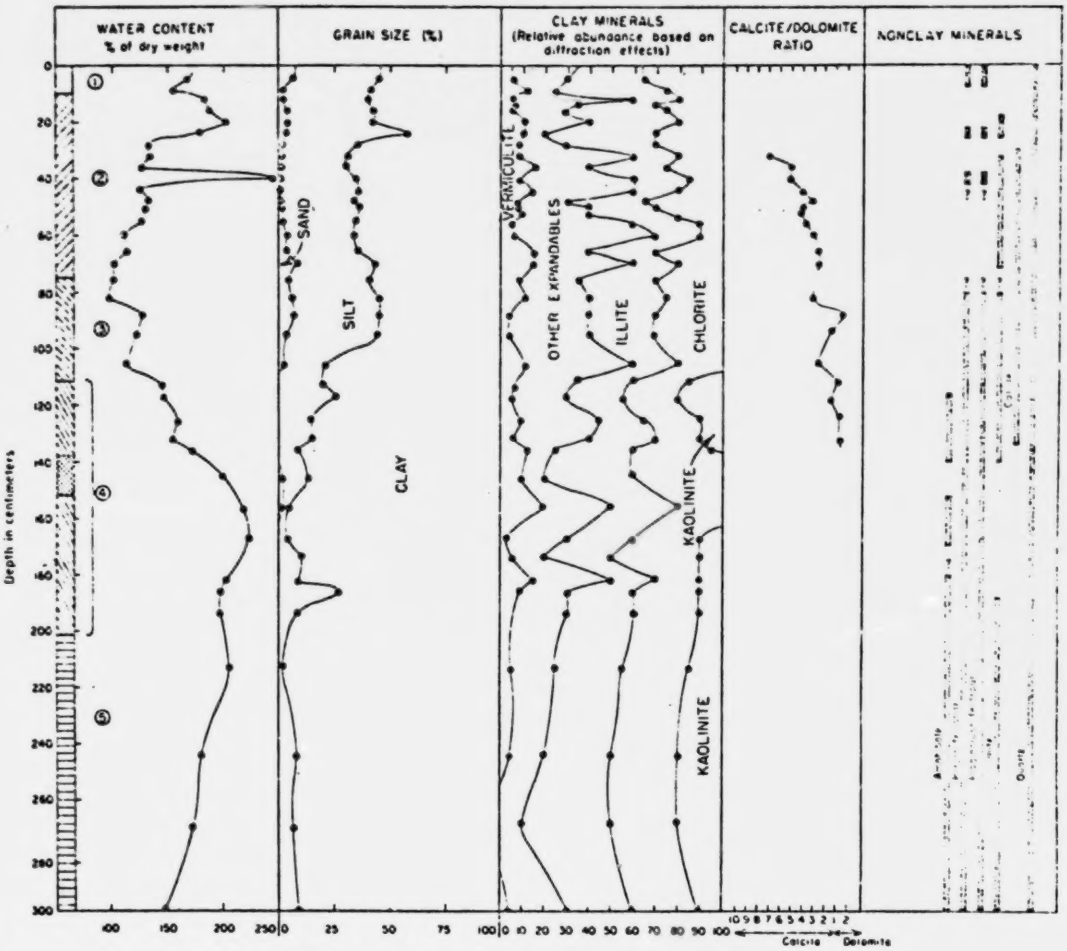


Fig. 5 - Grain size and mineralogy of core 145.

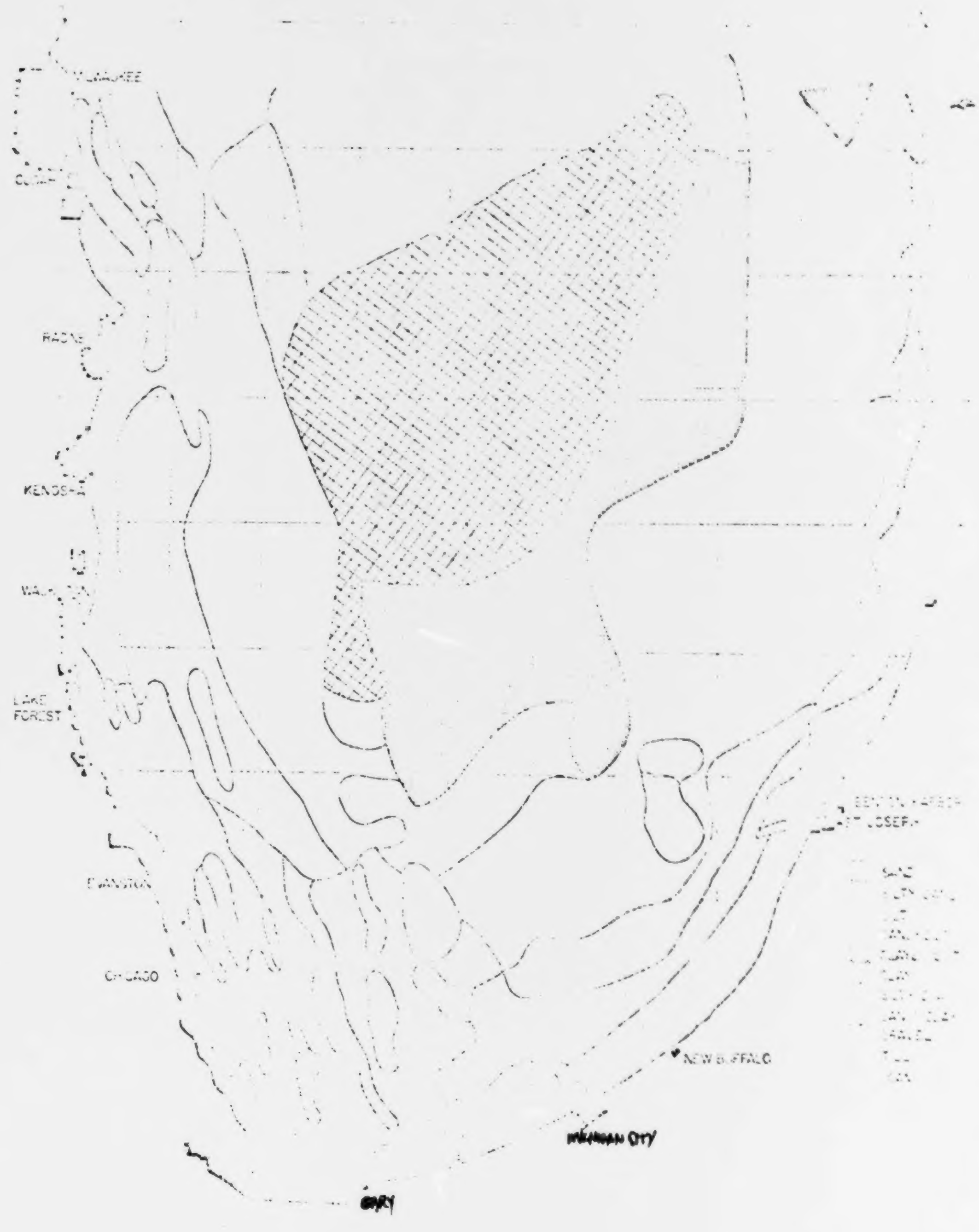
Taken from Fig. 4, I.S.G.S. Environ. Geol. Note No. 30.

Reproduced from best available copy.

Fig. 6

Surface sediments on the bottom

of Lake Michigan



Here are our specific views on thermal input standards for the lake:

We have reservations about the effectiveness and correctness of any blanket temperature standard that might be imposed at the present time. Among other things, lake water, temperature, current velocity and direction, turbulence, wind force and direction, as well as the wind exposure of the facilities, rainfall, lake depth, bottom topography, bottom sediments and the biota are all elements that will control the effect of thermal input and distribution. Because of the large number of these seasonal, daily, even hourly variables, which are different for each input site, each site should be considered and controlled as a separate entity.

If input to the lake is allowed, then we recommend that each site be thoroughly studied before construction and closely monitored thereafter, not only for temperature levels, but for effect on the various components of the lakes. Various scientific, governmental and private organizations could combine to accomplish such studies much as is now being done in the Waukegan-Zion area.

In final analysis, however, our knowledge of the lake is still so small and the value of the lake resource so valuable in terms of its use for hundreds of future years, we would welcome the exclusion of input of any kind to the lake that does not equal or exceed the optimum conditions now existing in the lake.

TESTIMONY OF JOHN D. HARPER, DIRECTOR
ENVIRONMENTAL PARAMETERS RESEARCH ORGANIZATION
SUBMITTED TO
LAKE MICHIGAN ENFORCEMENT CONFERENCE WORKSHOP
CHICAGO, ILLINOIS
SEPTEMBER 28 THROUGH OCTOBER 2, 1970
FOR INCORPORATION INTO THE RECORD

PREVIOUSLY SUBMITTED TO
ILLINOIS POLLUTION CONTROL BOARD
SEPTEMBER 25, 1970

TESTIMONY OF JOHN D. HARPER
BEFORE THE
ILLINOIS POLLUTION CONTROL BOARD
FIELD MUSEUM
CHICAGO, ILLINOIS
SEPTEMBER 25 AND 26, 1970

Mr. Chairman, Members of the Board, Ladies and Gentlemen:

My name is John D. Harper. I reside in Hanover Township, Cook County, Illinois. My education and training is in engineering, both civil and mechanical. I am a Director of a non-profit Illinois foundation known as Environmental Parameters Research Organization, or by its acronym, EPRO. EPRO's chief function is the scientific investigation of problem areas in our society. EPRO is funded by private contributions and foundation grants and derives no part of its income from vested interests, either pro or con, on the subject matter under investigation. For example, the EPRO program for an ecological study of Lake Michigan's western shore between Waukegan and Kenosha is not funded in any part by either the power companies or governmental, federal, state or local, regulatory agencies.

In a publication entitled, Water Pollution Problems of Lake Michigan and Tributaries, January, 1968, issued by the Department of Interior, FWPCA, Great Lakes Region, a recommendation was made on page 66 as follows:

> "14. A special investigation be made of the effects which the installation of large power plants, both fossil-fueled and nuclear, have on Lake Michigan; this investigation to include studies of benthic fauna, radioactivity, water temperature, heat diffusion and lake currents."

At the four state conference on pollution of Lake Michigan and its tributary basin held January 31 through February 7, 1968, the conferees recommended the formation of a special committee on nuclear discharges and thermal pollution aspects of nuclear power reactors. This committee, chaired by F.W. Kittrell, did its work and reported to the second session of the four state conference on February 25, 1969, with several recommendations, two of which I would like to point out at this time:

> "6. FWPCA coordinate a comprehensive study of the effects on water quality and aquatic life of thermal wastes from a large nuclear power plant on Lake Michigan, with attention to various methods of cooling water dispersion.
>
> 7. FWPCA coordinate a study of the effects on water quality and uses of radioactive wastes from a large nuclear power plant on Lake Michigan, with especial attention to the concentration of radionuclides in aquatic life."

In the fall of 1969 I inquired of the then FWPCA, now FWQA, what action was intended commensurate with the recommendations of the Kittrell committee. It was my understanding that because of budgetary considerations, the recommendations to study the pre-operational and post-operational site of a nuclear power generating facility could not be undertaken to the extent recommended by Kittrell's committee. Recognizing that it would be imperative to have data obtained in-situ upon which to evaluate the impact of a nuclear power generating facility on the local environment, several scientists and other individuals including myself formed a group to initiate and conduct a multiparameter ecological study of the western shore of Lake Michigan centering about Zion, Illinois.

In the publication, Physical and Ecological Effects of Waste Heat on Lake Michigan, issued by the U.S. Department of Interior, Fish and Wildlife Service, September, 1970, it is stated on page one:

> "Everyone concerned with the problem agrees that not enough is known about the ecological effects of massive heated effluents and that a great deal of research is needed on this problem. Unfortunately, the information is needed now; since it is not available, however, interim standards must be set for Lake Michigan on the basis of existing knowledge."

On page 91 of the same report the concluding recommendation is:

> "11. On the basis of the above points, it is concluded for ecological reasons that no significant discharge of waste heat into Lake Michigan should be permitted."

I agree with these two statements as I do with most of the material presented in the report. As is so often the case, when decisions must be made effecting the utilization of any of the Great Lakes, be it Lake Michigan, Lakes Huron, Superior, Erie or Ontario, the decisions are based upon little, if any, knowledge that we possess of these lakes concerning their biological, chemical, physical, geological and meteorological characteristics. The scientific research activities in the Great Lakes, and now let us confine ourselves to Lake Michigan, have been minimal in the last three or four decades and practically non-existent before that. Some educational institutions bordering Lake Michigan namely University of Michigan, University of Wisconsin at Madison and at its Milwaukee campus, and DePaul University in Chicago, have recognized that in depth multiparameter scientific studies of Lake Michigan are imperative if answers are to be found for the many questions confronting us today.

One of the major reasons why research in Lake Michigan and the other Great Lakes is so far behind similar oceanographic research in the saline waters in the Atlantic, Pacific and other oceans of the world is the unique fact that the Great Lakes have no military application.

No submarines are permitted to operate in the Great Lakes by treaty with our neighbor to the north. Those submarines that are in the Great Lakes have their propellers removed and are strictly for training purposes in the former Corn Belt Fleet of the U.S. Naval Reserve. Now it may seem odd that the lack of military application to the Great Lakes would be a factor in our present limited knowledge of these bodies of water, but when you realize that a great preponderance of the data collected in saline waters is to determine the conductivity and temperature of the water for the express purpose of plotting the transmission and propagation of underwater sound waves which in turn has a great bearing on underwater military capabilities, it becomes obvious that with no need for this data in the Great Lakes because of the absence of submarines, the basic data we need, along with all the attendant biological, chemical and physical data that is simultaneously obtained, is lacking. Now there have been scientific cruises on Lake Michigan conducted by the University of Michigan on their ships and conducted by the University of Wisconsin on ships of convenience, usually the Ludington car ferries. DePaul University has availed itself of the opportunity of using a research vessel that is operated by EPRO for the purposes of graduate instruction in the aquatic sciences and for biological research and surveys of existing pelagic and benthic life. In the context of a complete over-all picture of Lake Michigan, it is necessary, it is imperative, that research activities in the lake be conducted continuously throughout the year at innumerable vertical and horizontal stations. This one shot, one observation approach as has been conducted by so many of us can be disasterious if as we find, extrapolations are made on the data presented involving a host of complex issues such as that which is before this Board today. I would liken the data from the present state of Lake Michigan research, if I may, to information sent by the wife here in Chicago of a GI in Viet Nam who has written that the temperature was 92 degrees in Chicago in mid-September,

1970. The GI's buddy may have received a letter from his family also in Chicago a few days prior or later that indicated the temperature was 47 degrees. The picture they have so far removed from the scene, as far removed from the conditions in the lake as we are now, seem vastly different and would be confusing. While the data that has been collected to date is of extreme value, it is all we have; and it is necessary to obtain considerably more before the momentous decisions effecting regulatory agencies, such as this Board, can be enacted with the degree of certitude so necessary on such complex issues.

The major reason there is a dearth of information about the lakes is that funding sources are practically non-existent. The Sea Grant Universities of the University of Michigan and University of Wisconsin have some small funds that can be earmarked for activities in the lake. Other universities, including DePaul, that have evidenced interest are hampered by budgetary considerations that preclude a viable effort in the lake. If no funds are going to be available, which has been the case to date, then we shall continue to be ignorant of the many complexities that we should be aware of when decisions effecting all of us, such as the siting of once through cooling water power plants, must be made. I respectfully urge the Board to do everything in its power to make available the means whereby institutions desiring to conduct studies of Lake Michigan are adequately funded.

Some regulatory agencies occasionally engage in water and bottom sampling for the purpose of determining existing criteria as it relates to their operations. This is to be commended and encouraged, and it is hoped the data that is obtained is made available to all wishing to utilize it. One factor that influences the frequency of sampling is the capabilities of the watercraft the agency utilizes to take the samples. Lake Michigan, as you gentlemen are well aware of, is moody and reacts quickly to changing meteorological conditions.

It is often said by the foreign flag seamen that they prefer the North Atlantic to our Great Lakes at their worst. The combination of storms and squalls can impart heavy damage on shore-site facilities, underwater construction and ships and boats on station in the lake. Very seldom can a 16 ft. outboard be used in Lake Michigan as it could in the Des Plaines River for limnological studies. Even a 30 footer in the lake must take all precautions because of the rough sea situation that can occur. EPRO employs a 54 ft. steel hulled vessel and will have in operation next year a 100 ft. research vessel for the purpose of greater capability in the lake on a more consistent basis. The ship time operating cost on the lakes for research purposes approximates that in dollar value of those research or oceanographic vessels operating on the oceans. For those agencies that are oriented along the lines of a 16 ft. outboard doing all the work for them, this can be quite shocking. To conclude now, gentlemen, I would like to emphasize that considerable additional research is needed in Lake Michigan now and that the funding to conduct this research must be obtained if the questions we are being asked today about the eutrophication of the lake are to be intelligently answered so that we may wisely utilize and preserve this great natural resource. The position of myself and the organization I represent is that at the present we do not have enough knowledge on what impact the introduction of heated cooling water from nuclear or fossil-fueled plants will have on the lake's biota and chemical and physical characteristics. Without sufficient data upon which to base an educated appraisal of the situation, I suggest that a Moratorium, voluntarily accepted by the power companies and the regulatory agencies, be immediately established on once through cooling water power plants, be they nuclear or fossil fueled. It should be agreed between the parties that those generating stations now nearing completion or completed employing the once through cooling water system should be permitted to operate contingent upon the establishment of provisions to modify deleterious effects if they become evident, that application for construction of once through cooling water type plants be suspended and/or modified to comply with future regulations to be promulgated after the investigations of existing once through cooling water facilities are fully known. This Moratorium on future once through cooling water type electrical power generating stations should satisfy reasonable men that all efforts are being made to serve society with both ecological and economic consideration.

TESTIMONY

HEARING ON PROPOSED THERMAL STANDARDS FOR LAKE MICHIGAN

ILLINOIS POLLUTION CONTROL BOARD
Chicago, Illinois
25, 26, September
1970

Mr. Richard J. Kissel, Hearing Officer

I am Mary Alice McWhinnie, professor in the Department of Biological Sciences at De Paul University in Chicago, and Director of the De Paul-EPRO Ecological Study of Lake Michigan. My credentials for speaking to this Board relates to my professional experience in crustacean biology in study of effects of temperature changes on invertebrate animals in fresh water and Antarctic marine water, and to the work we are engaged in on Lake Michigan.

Mr. Chairman. I am pleased to respond to the need for information on the complex topic of the ecological influences of industrial use of water resources in general, and Lake Michigan in particular. I believe that the need is high, first because of the long term plans which call for the use of lake water by the rapidly expanding development of nuclear powered electric generating stations, and second, because of the unprecedented concern for environmental quality. The plans for the future are increasingly well known but, for coherence of presentation I shall briefly restate them here. In an AEC report of June, 1970 it was stated that:

16	nuclear plants were operable at that time, producing,	5,073,700 KW
54	were in construction, to produce,	43,756,900 KW
34	were planned, to produce,	32,591,000 KW
8	were in earlier stages of planning, to produce,	7,589,000 KW

giving a total of 113 plants within the U.S.,
to reach an expected production of , 89,010,600 KW

100 of these are in the eastern one-half of our country and

all are expected to be in operation by 1978. As of September, 1970 a longer term projection was published by the U.S. Department of the Interior under the colloquial term of a 'white paper', wherein the predictions were confined to Lake Michigan. The values cited there were derived principally from a report by Acre (1970) and represent the sum of both fossil-fuel plants and nuclear powered plants. It is realistic to treat the two types of plants together since heat, the topic of these hearings, is a common by-product of any electric generating station. Briefly, assuming, a) no change in stations planned; b) no change or improvement in technology throughout that time; c) no increased efficiency in energy production or utilization between 1968 and 2000, the growth in electric power production and heat loss have been estimated to be:

	1968	2000	Increase
Kilowatts (at full capacity)	7,600,000	73,500,000	9.6 fold
Energy loss as heat (billions, BTU's/hr.)	29.85	414.67	13.8 fold

Other sources of heat addition to Lake Michigan are negligible in contrast. However, whatever its source, the question we are asking is, "what are the ecological consequences of heat addition to Lake Michigan, and what are our alternatives concerning policy and standards"? It has been recorded in many places that the present state of knowledge on the environment and the complex interdigitation of physical, climatic, chemical and biotic characteristics is too poorly understood to state, with certitude, what the effect of thermal additions will be on the ecosystem and that only a thorough ecological study of an area to be influences, will provide the information essential to knowing whether such technological developments can be borne by the environment. Alternate views hold that interms of the possible effect of such heat additions (based on the projected growth), caution directs that an upper limit on thermal increment be set or, that no increment should be allowed. These views have taken the form of three proposals which, in general, state that use of natural water shall not increase its temperature, more than 5°F (or 3°F) above 'natural ambient' temperature; it shall not exceed 85°F (29.4°C) or, it shall not exceed 37°F (2.8°C) to 77°F (25°C) depending upon the season, or, that heat at any level shall not be added to a natural body of water.

I have at least a limited appreciation of the need for, and the responsibility of, regulatory policies to protect our environment. However, within the context of existing data I do not believe that we are in a position to justify a fixed value, such as these are, as a consequence of the variables with which we are faced. I am aware of the fact that such a statement as this provides no support or assistance to policy making bodies; I appreciate that a degree of risk prevails when delays are encouraged in the interest of establishing securities against environmental deterioration. I am further aware of the most difficult of truths relative to seeking 'best estimates' concerning the development of policies; namely, that one who is concerned about thermal dangers can cite published scientific data which indicate that certain selected species of organisms have been shown in laboratory study (or field) to have upper lethal temperature values which will be reached with waste heat addition; contrariwise, others recognize such a possibility but take a more moderate view, and can also cite published scientific data which show that certain selected species are taken to their biological optimum when provided a warmer environment. Each is right, each is honest, each is scientific and each is supporting his views to the best of existing knowledge; they differ in their intuitive sense and their disparity reflects the presently unacceptable reality that we do not have definitive information which will provide the solid platform of knowledge upon which reasonable and realistic policies should be based. In this context I should like to present some data which of necessity ~~is~~ ARE selected, but that which will hopefully place in balance the perspective of persons who have the responsibility to deal with this problem.

The following unpublished temperature data have been derived from Lake Michigan in the vicinity of Waukegan and Zion, Illinois during the summer of 1970:

Vertical Water Temperatures (6 July 1970)

	Waukegan	Zion	
	Sta.# 52	Sta.# 1	Sta.# 7
CDT	(0945)	(1115)	(1530)
	16.5°C (61.4°F)	16.3°	17.0° (62.6°F)
	16.4	16.2	17.1
	15.5	16.0	16.4
	15.4	15.5	15.9
	15.3	14.8	14.5
	15.0	14.5	12.9

Vertical Water Temperatures (30 June 1970) (1320-1515 CDT)

Waukegan

Sta.# 50	Sta.# 51	Sta.# 52	Sta.# 53	Sta.# 55
17.2	16.7	16.7	18.2	19.4
15.6	16.0	16.5		16.2
15.3	14.8			
14.0	14.6	15.8	15.1	14.0
	14.0	14.6	14.3	13.5
	11.2	14.4	14.2	13.2
		14.3	14.0	13.1

Vertical Water Temperatures (24 Aug. 1970)

Waukegan

Sta.# 50	Sta.# 51	Sta.# 52	Sta.# 53	Sta.# 54	Sta.# 55
21.3	20.2	20.9	21.0	21.2	21.6
20.6	20.0	20.9	21.0	21.2	21.6
22.2					
	19.4	19.4	23.0	20.8	21.2
	18.9	19.2	19.4	19.8	20.0
	17.4	16.5	18.6	18.4	18.4
	15.2	14.0		16.4	15.6

These values have been given to indicate that:

- a policy limiting thermal increments to less than, "a 1-degree Fahrenheit rise over natural water temperatures at the point of discharge", cannot in my opinion be achieved since, in practice, most, if not all, uses of water result in some thermal increment, if for no other reason, residence within the facility using the water;

- a policy limiting thermal increments to +3°F (1.6°C) or +5°F (2.8°C) must also qualify under what solar heat input level, or at what time of day?, or at what point in space (and I understand 'at the outfall')?, and under what current (and wind) conditions?

_ a policy limiting a thermal increment to a mixing zone whose length or radius is 5280 Ft. or less does not reckon with currents and/or wind action; there are some data which suggest that under certain wind conditions a 'tongue' of warmed water may extend 2-3 miles in what is apparently a narrow band along a shoreline current; this will in all probability apply to any body of water warmed by any means.

At this point I am concerned that these points can lead to the notion that, "about nothing can we be sure", and further, that due to the complexity of physical factors we cannot reach a realistic and practica-ble standard with respect to thermal modification of the aquatic environment. While there is some truth to this I do not see the disabling objections to be unsurmountable. I do see them to be significant in their call for study and, in their call for a reluctance to specify a numerical limit with respect to any environmental parameter with our present state of understanding, in particular, " x°F " or, " x ft. " for a mixing zone.

It can be legitimately asked, how can a biologist view that which is more widely held as an environmental threat, with such seeming insensitivity? In answer, may I offer:

- I do have reasonable concern for thermal increments in the aquatic environment;
- I do recognize that the environment has a finite "carrying capacity" for chemical and physical additions or variations; I am in full agreement with Sorge (1969) that while a heat dissipating source may raise the temperature of a receiving body of water only a few degrees within a limited area from the discharge canal, an accumulation of heated effluent from many sources could prove disasterous over many miles. Thus, the projected increase in number of sources using Lake Michigan water in the next 30 years could prove to be ecologically critical. The limit of heated effluents which an ecosystem can endure without adversely altering its biological balance can only be determined by a total ecological study of an area.
- I do recognize that biotic communities respond differentially to variations in physical or chemical qualities in their environment. This notion has been fundamental to the principle of succession as evidenced in ecological systems; some data I have presented for fish can be cited again,

Fish Species	Temperature Preference
Carp (*Cyprinus carpio*)	32°C (89.6°F)
Perch (*Perca flavescens*)	24°C (75.2°F)
White Fish (*Coregonus clupeaformis*)	13°C (55.4°F)

- I am aware of the direct effect of temperature on natural phenomena and thus on biological systems; I recognize that temperature increases are often employed to increase biological activity.

- I am convinced that while highly controlled laboratory physiological studies on particular plants, animals and microorganisms have contributed significantly to our understanding, that we cannot extrapolate these findings directly to the natural environment; these two approaches complement each other, -- they are not a substitute for each other.

With these and other considerations I should like to cite some data which bear on this subject.

In a study of benthic fresh water protozoa, Cairns (1969) has reported that small gradual increases in temperature have no effect on the protozoan community of the Savannah and Potamac Rivers; this conclusion prevails after 9 years of a study still underway. The temperature increase was downstream of a heated water discharge and the water temperature was "a few °C over ambient". On the other hand Cairns had previously shown (1968) that a sudden temperature shock caused major changes in the number of species present. The differences between 'chronic' and 'acute' temperature changes are well known and apply generally to all species of organisms. In the 1969 study a temperature shift of 20°C to 35°C (ca. 95°F) within 10 minutes and sustained for 6 days showed an increase in protozoan species on the sixth day after an immediate decline from 26 to 7 species apparently surviving. In another similar experiment where the experimental temperature was shifted abruptly from 21°C (69.8°F) to 31°C (87.8°F) the number of species fell from 34 to 21 and within 32 hours had returned to the initial value though the temperature regime lasted three days. Shock effects such as these are not likely to occur in nature and thus the effect on species diversity would also be less. In any case these data indicate no effect on a protozoan community.

At an earlier time (1956) this author showed that different temperature levels did influence the relative predominance of algal groups, e.g., diatoms were the predominant types at 20°C (68°F) and below; green algae were predominant at ca. 33°C (91.4°F) while blue green algae developed maximally at 40°C (104°F); this phenomenon has been called competitive exclusion and relates to the earlier reference I made to succession of biotic communities as environmental conditions shift in any aspect.

Benthic marine molluscs (mussels) and fishes were shown to be more sensitive to temperature increases (Pearce, 1969) and, while the commercial mussels had somewhat different tolerances to temperature depending upon their point of origin (intertidal or littoral) at 24°C (75.2°F) abnormalities appeared (attachment, clustering, etc.). However, their southward range was a region of 26.7°C (ca. 79.5°F) indicating perhaps tolerances developed in larval life not capable of adjustment in adult life. In this same study starfish and snail feeding activity declined at temperatures above 20°C (68°F). Nauman and Cory (1969) studied benthic animals by way of test panels placed at the intake and outfall of the Chalk Point, Md. fossil-fuel plant in the Patuxent River. The temperature difference between intake and outfall was approximately 6.3°C (ca. 11.5°F). Comparison of the animal populations showed a 3-fold increase in biomass at the outfall relative to the intake with little or no change in species composition between the two. The epifauna represented considerable diversity including some 25 species from 8 major animal groups (including nemertean worms, flatworms, annelid worms, amphipods, bryozoans, anemones, clams, protochordates, and a variety of crustaceans). The temperature range of the effluent, seasonally, varied from ca. 10°C (50°F) to 37°C (98.6°F) and production was based on dry weight. Species diversity, a ratio of number of species present to the total number of individuals present, did differ between the two points and was generally higher at the outfall. Some species disappeared at the effluent at certain seasons but were found in abundance just outside of the effluent canal (thermal preference/ gradient). An increase in size of barnacles occurred at the outfall and higher production occurred there even with fewer species present (ca. 3-fold greater than at the intake). Summarily, in the epifaunal community there were differences in species number (more, though some species disappeared at certain months), total number (more), biomass production (more), and species size (greater) as a consequence of a thermal increment. During the warmest months (July, August) fewer species were present at the outfall.

Barnett and Hardy (1969) in a summary report of marine benthic clams (*Tellina tenuis*) studied a coastal environment (Scotland) for four years before a heated discharge appeared in the environment and for five years after. They report that there were large seasonal fluctuations in *Tellina* but that none of the changes were attributable to warm water effects. Conversely, *Tellina* grew more rapidly in the post-effluent years with the greatest difference being in young stages and there was no evidence of a difference in the spawning characteristics between the two studies (pre-, and post-). However, the snail *Nassarius reticulatus* while not different in population density, showed thinner shells than others in the species range which were not influenced by the thermal increment. Advanced breeding and egg hatching occurred for a species of snail, a copepod and amphipod in the vicinity of the thermal discharge. These species are *inter*tidal; no effects were observed in *sub*-tidal bottom communities.

The scientific literature is available for anyone to obtain examples of this kind. As I noted earlier, scientists have, and probably will continue to present, examples that place emphasis on various aspects of biotic responses to changes in environmental temperature. Despite this, regulatory agencies are unable to set realistic and meaningful limits concerning the use of natural water resources for excess thermal discharges, --- because we lack an understanding of the carrying capacity of them. As time passes and more uses are planned for water sources we must cease to be in this position and, in my judgement, only hard data will make that possible.

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MR. STEIN: Thank you, Professor McWhinnie. (Applause)

Are there any comments or questions?

MR. FETTEROLF: Yes.

Dr. McWhinnie, I believe you are speaking strictly as a scientist who has been working in plume areas, and lest there be any doubt, could you cite some of the sources of the funds, the money that enables you to do this work?

DR. McWHINNIE: There is a moment every day when I grow facetious and I never know when it is going to hit. But let me say that a year ago, the Environmental Parameters Research Organization was founded and incorporated within the State of Illinois as a not-for-profit organization about which I knew almost nothing. Only later did I come to know about it. And I learned that its director and founder did, in fact, on his own obtain from a proprietary interest of his funds that would go into this non-proprietary organization.

Perhaps like any power company or any other such group, he reached out to try and find scientists who might have a commitment to the environment, and thus he did come upon some of us, and the program was worked on through last winter and it was initiated in the field last spring.

But the funds were rather limited, and I regret to say that in my own inimitable fashion I went screaming to the president of the university and said, "I have to have money." And, as everyone here would know, if you don't request it a year ahead of time, and if you don't get it written into the budget, there isn't any.

But somehow in his own commitment, which was demonstrated when, as chairman of the department of biological sciences in the early sixties, he held the first privately sponsored water pollution conference in Illinois — and I am delighted to say that Mr. Murray Stein was its luncheon speaker in 1962 -- I am not sure he remembers -- but, in any case, that man is now president and he brightened my life and gave me a little money and we are once again at the edge of those funds.

I have two choices. Let us not be so foolish as to think that those of us who undertake such a project as this are not attracted to those upon whom the press of information is the greatest. You call them power companies.

Yes indeed, ladies and gentlemen, they have attempted in, I believe, their own motivation to finance this; they have tried to give us money. I am grateful for a typewriter and a carbon copy. For anyone present, we can demonstrate that in a state of destitution we had the guts to say, "I am sorry. I can't take your money."

And, as the president said to me recently when I said, "You know, I have these people on the payroll and I don't have any money."

He said, "We will try and find it someplace."

How unfair is an American public that demands that the burden of proof is on the user, and they deny the scientist the right to use those moneys? But this is where we have been put and given an infinite commitment to the objective reality of truth, I should say, "By God, we will do it." And I don't know where the money will come from.

MR. STEIN: Do you have any other questions?

Miss McWhinnie, I appreciate your statement, but let's go over some of your points here.

As you know I am a lawyer. I know I have met many old friends among the legal profession attending during this week, as well as a lot of new ones. As lawyers always do we have listened to the jargon of the scientists and I have no quarrel with it; I appreciate it. I think your paper is couched in those terms. But when you talk about the discussion and use terms such as "testimony," "witness," "cross examination" -- and I think I have allowed questioning to approach that because it seems that is what the people want to do inasmuch as in the profession that is the way they conduct their business -- I think you have to recognize that we were employing the jargon of the lawyers and that is how we do our business.

This was in no way a trial. This was a workshop and a discussion. However, the participants in this workshop were lawyers -- lawyers by long training and by long experience. They didn't shed their personalities when they came in here as the scientists didn't shed theirs, and we have to expect that.

So I think in that sense those terms got into this, but no testimony was given under oath. We permitted the witnesses latitude in question. We didn't require proper foundation or we didn't require the technical rules of evidence. I really do think that we all understood the rules under which we were working here.

So I wouldn't place too much credence on this. I think we have an amalgam here of both the legal jargon and argot and the scientific jargon. I have no preference for either, but I think everyone has to do his own thing and say it his own way if we are going to try to achieve an accommodation in these matters.

DR. McWHINNIE: May I --

MR. STEIN: Yes.

DR. McWHINNIE: I would only caution that we do not drive the wedge against the credibility of scientists across this land. Today did we not hear a Representative use an expression "paid mercenary experts"? This has deep impact.

MR. STEIN: Professor McWhinnie, if you are sensitive to that -- and I appreciate you might be -- we lawyers get called that all of the time and this is, I think, a price you pay.

DR. McWHINNIE: That is the price I would not pay when, in fact, funds might have been available to carry on a study that this Agency needs carried on.

MR. STEIN: Well, I think you are talking about -- the funds is another matter. As a matter of fact, I don't know the details of that at all. I really don't.

DR. McWHINNIE: No, no, no. My point is: Do not put us out of credibility. The American people need every segment of society.

MR. STEIN: Surely.

DR. McWHINNIE: But already there is such doubt cast upon the scientists that his data will convince no one.

MR. STEIN: It may. But here is the point. We don't have a plutonian elite running our socity. You may probably from your point of view point up those disciplines that -- that we have to get the answers. We can't get them from "legal boxes." I don't believe we ever have "legal boxes" for those disciplines -- physics, chemistry, biology, meteorology, geology, engineering and the environment. It would be nice, and I know you think it would be nice to have this. But I think we have heard from the public here, and long ago, as Clemenceau said, "War is too important to be left to the generals." I think we have heard that the public feels that the environment is too important to be left to the scientists, the public officials and the lawyers. (Applause) That is why they are here. We have to face this.

Now, the hotel is signaling, and we will be out in a few moments.

Now, the other point I think is that the lawyers have a way of looking for the truth, too. It may not be scientific truth, but it is the kind of truth as proven by our society that can arrive at an accommodation within our form of government where we can move forward to the next step.

Truth in the abstract is always a problem. I am not talking about that. But I am talking about truth in the sense that when we have divergence such as we have here it may be the great seamy part of society, but that is the miserable job that we lawyers have in trying to get all of these elements together -- trying to get to the truth as best we possibly can, groping toward it as expertly as we can to come up with a conclusion so all parties know the rules and we can at least hopefully move forward.

Now, I recognize that from many philosophic or scientific points of view you may not consider this the ideal way to move.

DR. McWHINNIE: I do not have any grief with lawyers, if it is true -- and I think that this is a science-based problem -- but then we must not close the door on the scientist; we need his answers just like we need the lawyer's answers.

MR. STEIN: That is true. But, ma'am, if we are faced with the situation -- I am reminded of Senator Hart's telegram, and I don't think he said much different. I just raise this as a question that you pointed out as a conclusion, but I will get to that in a moment.

The point that Senator Hart raised was, in view of the fact that we are dealing with a complex scientific problem where every answer is not yet in, should we not employ the technique that we have employed many times in our society in getting some kind of change, either to society or our environment, by using the principle of burden of proof? And that is what he suggested, and I certainly have not talked to Senator Hart about this. We have been having enough discussions about mercury and heavy metals to get into other issues lately. But I think his telegram seemed to me to get to the same point that I was making, and I think Attorney General Scott made the same point. Maybe this is the point that comes from our professional background, and when you get a complicated situation like that the way you take the first step is to fix the burden of proof and let the parties who are responsible come forward with the scientific evidence or any evidence which will cause you to move.

DR. McWHINNIE: I agree. But when the burden is upon them do not deny them the only group who might be able to provide it. And I regret that distinguished scientists this week -- one a member of the National Academy of Sciences to which neither you nor I are good enough to be so named -- was not even allowed to scientifically answer the charges against his work because he had gone home. And this is not common in my community. Scientists speak freely to each other. They don't get put into "legal boxes," so that they cannot reach each other. This is all I seek.

MR. STEIN: Oh, we have another rule in the law, and that is -- and I guess we have to do this -- what we do is give people an opportunity to be heard, and that is just an opportunity. If they are not here and don't avail themselves of it, what can anyone do? The hall is open. The notice is out. You have to show up in order to be heard, and if you leave, that is your privilege, but there is no way that we can chain a man here when we are not exercising subpoena power.

DR. McWHINNIE: Whatever was the mechanism I do not know. But I think those questions should have been placed to those scientists by those who later stated them at the time that it was fresh in the mind of the conferee and fresh in the mind of the participant.

MR. STEIN: I have one last point, and I hope you won't take this too personally. But you talked about some "ticky-tacky" point on quotes from a "white paper" where part of the information was put in and part not. I believe you were here for most of the week. I believe you have talked before public bodies in the past 15 or 20 years -- congressional committees and many other public bodies -- and yet what do I find? When you criticize the "white paper" -- and I am not commenting on your criticism of leaving something out and putting something in -- and from the precis I find -- after you have probably heard my views all week and remember me possibly from 1962 -- that I get a quote that you attribute to me from a newspaper.

DR. McWHINNIE: Oh, please, sir, this I would not do. Please read the text --

MR. STEIN: Yes, I read it.

DR. McWHINNIE: -- in which it was stated what Mr. Stein said because I, too, have deep concern for the accuracy of the press.

MR. STEIN: I have no concern, I repeat, I have no concern about the accuracy of the press. I want to say here that these concerns I hear about the press not reporting things right is not a fair criticism. I find we get fair reporting practically all of the time.

But, Professor McWhinnie, the question here is that if we are seeking the truth, I would prefer to go to your work that I have heard of, or your statement or your verbatim testimony than use any quote in the paper. However, I might rely on that paper as an expression of your view.

DR. McWHINNIE: I must not speak clearly. That quotation is only to emphasize the position that I think has been taken -- "The burden of proof is upon the user." It is known everywhere. It is even said of Mr. Stein in the Chicago Sun Times. Now, if this is true, don't close the door.

MR. STEIN: Again, let me make my position clear, because I don't think this is what I said. I raised the question for the conferees. I didn't come to a judgment.

I raised the question to the conferees. They have to make this judgment; I have not come to the conclusion but I am raising the question with them. This is the essential point of this conference. One of the major issues I hope to speak about in the executive session is: Is the way to handle this through the burden of proof? If it is, on whom should that burden of proof be? Should it be on the Government, or on industry, or a city which wants to use a natural resource? This is a judgment that they are going to have to make.

Now, I don't even know whether they want to take this approach, but I have framed this question again and again. I say independently a lot of other people have come forward with the same kind of question. All I ask is that I think this is a legitimate matter for the conferees to consider, to see if they want to adopt that approach. I have by no means said that I endorse at this point the burden of proof rests on anyone or is the avenue through which we will handle this case.

DR. McWHINNIE: May I just --

MR. STEIN: Just go ahead.

DR. McWHINNIE: I don't care upon whom the burden of proof depends; either side will need scientists.

MR. STEIN: Thank you.

I think we are all agreed. We are both agreed on that.

Now, are there any questions?

MR. OLIN: My name is Harold Olin. I am not a scientist, and I am not a lawyer; I am an architect, and I am proud to say I am a conservationist.

I would like to cross-examine this witness with your permission, but it will be brief.

MR. STEIN: Well, let me tell you --

MR. OLIN: It will be brief, sir.

MR. STEIN: Well, you know we have to be out of this room.

MR. OLIN: Okay. Can you state categorically from a scientific point of view that the 40 or 50 billion B.t.u.'s per hour which are being dumped into the lake at the moment are not damaging to the lake ecology?

DR. McWHINNIE: No, sir, I cannot. May I ask you a question?

MR. OLIN: As soon as I am finished with you. Thank you.

MR. STEIN: Pardon, sir. I am afraid --

MR. OLIN: I only have one other question, sir.

MR. STEIN: All right. Go ahead. I am not sure how much there will be.

MR. OLIN: How long do you think it would take to get consensus in the scientific community that it is or is not damaging? How many years?

DR. McWHINNIE: I would say we do not seek consensus, we seek evidence. I would further say that 2 years annual cycle multidisciplinary study preoperational is essential; 3, 10 postoperational.

MR. OLIN: Possibly 15?

MR. STEIN: I am sorry. You can continue this; we just have to give up the room.

MR. OLIN: Thank you.

MR. STEIN: I will tell you where the next room is, and you can have the floor. We will reconvene in about 15 minutes in the Randolph Room. You can find the Randolph Room on the lower level. Take the entrance downstairs through the College Inn Arcade on the main level, and we are all set up in the Randolph Room, and we will reconvene.

(Short recess.)

MR. STEIN: We will reconvene, if we may.

I don't know -- Professor McWhinnie, do you want to get up again? I think if any questions are going to be asked, I am going to ask the person on the floor to get near Mrs. Hall, of course, and speak loudly.

MR. OLIN: I have one final question. You have indicated that you could not state categorically that the heat is not damaging to the lake.

You have also indicated that it would take somewhere between 12 and 15 years in order to do an exhaustive study -- scientific study, of course, and I am just wondering whether you are proposing that we continue our current practices in the interim.

DR. McWHINNIE: May I ask a question? Given that what you say is true, the answer is no.

MR. OLIN: What are you saying I said? I am basing my questions on what you said, Professor McWhinnie, not on what I said.

DR. McWHINNIE: Under the moment of confusion, would you resay what it is?

MR. OLIN: Certainly. My first question was: Can you state categorically that the 40 or 50 billion B.t.u.'s per hour which we are currently dumping into the lake are not damaging to the ecology of the lake? And if I might remind you of your answer, your answer was that you could not state categorically that it is not damaging.

My second question to you was: How long would it take to get scientific consensus on whether the heat discharges into the lake are damaging or not? And you said that it would take an initial 2-year study and perhaps a 10-year study after that.

And my third question to you now, based on your two earlier responses, is: Do you propose that we continue the same current practice of dumping all of the heat from industries and from powerplants, municipal treatment plants, into the lake while these studies are being performed?

DR. McWHINNIE: With respect to the first, we do not know. We have information on which we make reasonable judgments.

I would ask you: Would you not expect to see deterioration due to heat increments at the Waukegan plant after 40 years of operation? May I ask if you would be kind enough to try and answer that? Would you expect this?

MR. OLIN: May I suggest that you haven't answered my third question and you are posing a question to me? I will be glad to answer but, you see, I am not a scientist; I am only an architect and an observer.

MR. STEIN: I am sorry. Again, I am going to have to act like a nasty old lawyer.

MR. OLIN: I would like the record to show that Professor McWhinnie has not answered my third question.

MR. STEIN: The record will show what you said.

Now, what I am going to have to ask is that you handle one question at a time.

MR. OLIN: Which I did.

MR. STEIN: Just ask one question at a time.

Do you have a question to ask or a comment to make to Professor McWhinnie?

MR. OLIN: The question was: Do you propose that we continue our current practice while these exhaustive studies are being made by the scientific community which might take, as you have indicated, anywhere from 10 to 12 or 15 years? That is my question. You have a choice.

DR. McWHINNIE: May I correct your 10 to 12 years or 15? I said 2 years before, 2 or 3; or 8 or 10 afterwards. You only added up the last numbers. And there is a danger in this.

It is my own plan and that of all of this confederation of scientists that surely we shall have supportable information 2 years, quote, preoperative; 3, postoperative. But we are not satisfied with an interim answer.

I would like to remind you that that lake does belong to the scientists also who share the concerns of everyone here. As a consequence, we will continue our studies when the public has long since gotten tired, but we will continue. For that you have your 12 to 15 years; not for an answer to the public.

MR. OLIN: Professor McWhinnie, I am not clear on what your specific recommendation to the conferees is with respect to a thermal standard, and that is exactly what I am trying to get to. These gentlemen are here to find out what you and the scientific community ought to be doing about a problem which exists now, in the view of many of your colleagues. And somehow your specific recommendation to me at least is lost in all of the scientific rhetoric. What is it you specifically recommend to these gentlemen here?

DR. McWHINNIE: In answer to that, I included in my testimony -- Mr. Stein, sometimes called a statement -- the position expressed by implication by Dr. Gustafson, by explicit wording by Mr. Harper. Let us, before debate defeats us, recommend a moratorium, but let us have an experiment and, thus, my recommendation would be in this category within the options open to this board of conferees but significantly also look at what the States of Michigan and Illinois have recommended and, of course, the third alternate, the Federal Government.

Based upon the probability, not the possibility -- anything is possible -- it is indeed possible that when I step out of this room, I shall be trampled to death by a team of elephants, but I don't think it is very probable. Within the world of probability, I believe, that with the information that we have, the recommendation from the State of Illinois, does not bode badly for Lake Michigan, and with a moratorium we can come to provide the answers that are needed when the moratorium would be left.

MR. OLIN: What do you mean by a moratorium? A moratorium on standards or a moratorium on thermal discharges, Professor?

DR. McWHINNIE: A moratorium with respect to the number of plants to be placed on Lake Michigan.

MR. OLIN: Is it your recommendation, then, that we should hold the status quo and not permit any additional plants on Lake Michigan?

DR. McWHINNIE: I would feel that the plants that are, or are in construction, would provide us the experiment we need. I would leave it to this board of conferees to make the decision, quote, "how many," "how soon?"

MR. OLIN: Thank you.

MR. STEIN: Are there any other comments or questions?

MR. READ: My name is Herbert Read.

Your comments about a number such as plus 5 on top of 50 or on top of 70 interests me. As I understand you, your number -- a plus 5 may be acceptable under certain circumstances but a plus 1 or plus 2 may not be acceptable under other circumstances, is that correct?

DR. McWHINNIE: You, too, must be a lawyer.

Do not read what isn't there. I am saying that it is unrealistic to say plus anything, and I carefully kept indicating "or, etc." If, by example, I can use one number, it is only an example, and, thus, the plus 5 or the plus 1, or the plus 3. I am saying it is unrealistic within the context of oscillating temperatures in an environment, variability in organism adaptation, they face from 32 to 85 every year anyway. What kind of sense could this board offer to prove the reasonableness of why they said plus something?

MR. READ: All right. In other words, since there seems to be no consensus of plus 1 or plus 5 or plus 10, either over 50 or 60 or 70, would you say the only way that we could be sure of anything is plus zero?

DR. McWHINNIE: If you are afraid of the possible, and you have no interest in the probable, plus zero, you are required to ask for. I face what is probable.

MR. READ: All right. In dealing with probabilities, then, can you come up with any number -- here again dealing with probabilities -- can you come up with any number that these gentlemen should consider?

DR. McWHINNIE: I have indicated that I believe reasonableness is represented by what the State of Illinois has been attempting to do.

MR. READ: Now, is that a number question here?

DR. McWHINNIE: I think this is a maximum 85 at any time.

MR. READ: I am from Indiana so I am not familiar with the Illinois situation.

MR. STEIN: Mr. Currie.

MR. CURRIE: If I may clarify that just a bit. There is an existing 85-degree standard in Lake Michigan water quality standards adopted by the State of Illinois. There is in addition a requirement that cumulative temperature changes be not more than 5 degrees from the ambient temperature, and that not more than 2 degrees difference be permitted within any given hour. There are presently for consideration before the Illinois Pollution Board two proposals to change those standards, and the State of Illinois has not so far either through my board or through Mr. Klassen's agency proposed any thermal standard for this conference.

MR. READ: All right. In view of the explanation here, the State of Illinois, under the explanation that was just given, did deal with figures, and government agencies do have to ultimately deal with figures.

We had a figure plus 5 mentioned, plus 2, under certain other circumstances. Then, is that the figure that you think that we could live with dealing with the probabilities?

DR. McWHINNIE: Dealing with the probabilities, I would say that I think we could live with considerably more than plus 5.

MR. READ: Well, then, what?

DR. McWHINNIE: I am sorry, sir, I will not name a number. There is no data that would support me.

MR. READ: Would you say that in the absence of data the safest thing to do, then, would be plus zero?

DR. McWHINNIE: I don't like to take that kind of logic to its ridiculous extreme. But in the absence of certainty that I am not going to be killed on the street, I should stay in bed in the morning. On these grounds, forgive me, but based upon the existing data, I would suggest that plus 5 is restrictive; 80 to 85 is realistic, in the receiving body. In those areas where plants are presently operated -- operating -- because I must emphasize the Waukegan fossil fuel plant has been operated for 40 years, and I am not supposed to speak until I have data --

but I can say this to you: that through 3 months of intensive effort this summer, I am sorry, we ain't got the evidence to support the position of concern which you show. I show concern but I will not react to that which is possible.

MR. READ: All right. So I want to state that at least I was able to obtain a statement of your position. I have been trying to determine what that was, and thank you very much.

MR. STEIN: Yes.

MR. COMEY: David Comey.

Miss McWhinnie, I am not a lawyer, so don't worry about my cross-examining you. I used to be an attorney though.

You spoke about the difficulty of finding funds to conduct thermal research on Lake Michigan.

DR. McWHINNIE: Only as for funds so you understand where I stand.

MR. COMEY: Well, I was in a similar position last year, and had to turn down a very interesting 6-figure contract to do a thermal pollution study near Chicago because the government agency that was funding it had some restrictions about publication which we didn't feel were consistent with academic freedom, so we turned it down. So I think on the moral level at least I can come into this conference with some sort of basis of perhaps equal with you.

The problem that I have is that I am basically concerned now with the public reaction, and you talked in your presentation this afternoon about capacities of the lake. Now, I think really this is what the public is objecting to and I would like to ask you --

DR. McWHINNIE: Excuse me, before you go on. I did not speak about the capacities of the lake. I did speak about the capacities of living organisms, and I think the record will show that.

MR. COMEY: All right. Could I extend that a little bit further? Do you believe there are such things as assimilative capacities to natural bodies of water for distinction of pollutants?

DR. McWHINNIE: I love the expression. Presented in the National Water Pollution Conference papers of 1960 in which the, quote, "Purifying Powers of a River, etc., etc., etc." -- yes, I do believe in this. I would be a fool to fly in the face of evidence that the living world is in dynamic equilibrium with its environment, and it will oxidize out, and it will take that which is organically useless, return it to a usable form for plant life, and the cycle goes on and on, and this was so ably pointed out then. The only problem is, our inputs are now too close, and we get so that the normal biological processes cannot carry on to completion what once they could, given the time.

MR. COMEY: You, I gather from previous statements before this in the Illinois Pollution Board feel that field studies are far preferable to laboratory studies.

DR. McWHINNIE: They are essential.

MR. COMEY: Let me ask you this: Would you be willing to conduct a controlled experiment on injecting cyanide, lead, mercury, or other pollutants of this sort not in a controlled laboratory situation but measuring rather large amounts of them out into Lake Michigan in order to determine exactly what the effect on the biota would be?

DR. McWHINNIE: I am deeply concerned over the constant analogies which don't fit together.

You cannot ask of a living system a question in the physical word, called thermal, and use as a fair example a toxic compound. This abuses knowledge.

MR. COMEY: Well, I would extend the abuse a little further. I would say that if a graduate student came to you with funds proposing to measure a capacity such as the following: Exactly how many rapes per hour a woman could tolerate; you would turn that down, and advise his graduate advisor. Similarly you would turn down any biological experiment on children with respect to how many beatings per hour they could take.

I think what the public is saying is: We are not interested in measuring parts per million of pollutants or B.t.u.'s per hour; if the technology exists, we want it all out. And that is what they are saying.

DR. McWHINNIE: I understand their question.

I would like to know why you started to call it thermal pollution. You made a decision. I am not prepared to make it.

Earlier at this conference, Mr. Stein speaking with some speaker -- I have forgotten -- asked: "Are you turning to the possibility of enhancement?" And the reply was, "Yes." And I wonder why we don't see two sides of every coin.

Who started the word "pollution"? Could they not have restricted it to "thermal modification?" Why has the decision been made? But it has.

MR. COMEY: Well, I believe that when I first began hearing the term in the middle 1960's, it was in industrial magazines such as Chemical and Engineering News. Nucleonics News attempted to change it in about 1968 to "thermal environment" but scientists changed it instead.

Well, I am concerned about the attitude that you have expressed, and I think that, very frankly, if this thermal conference is unable to remember something of this question and to adopt the idea of the zero standard, the public is going to be very disappointed. As a matter of fact, in Mike Royko's column the other night he talked about a rather interesting gentleman in King County he called Fox, who has been very carefully setting up outfalls and covering over caps of smokestacks.

His most recent exploit was to dump in an aluminum company the 50-gallon excrement that came out of their outfall. And I am afraid that the public may view this thermal enforcement conference as a test case and if in several months nothing has come forward, I am afraid the Foxes may multiply.

DR. McWHINNIE: May I speak to that?

The public should not be so ready to decide that this scientist or that one or the other one who cannot concur with them because of knowledge is their enemy. Let the public further know that I loved that lake long before they did.

MR. COMEY: But you also made the very patronizing remark --

DR. McWHINNIE: Let me finish. When the public takes it into its own hands to step beyond the normal course of events and hand it into the hands of our leaders who shall not act highhandedly, it shall be those who contribute to the anarchic breakdown of a country I live in and love. Let it be remembered that lake belongs to us. Our concern is not different from yours. Our experience may help us reach a solution that you too want. But don't you outdo us with your anarchy. (Applause)

MR. PETERSEN: I think, Mr. Chairman, at the risk of interrupting, we have been here for sometime. May I please suggest that this not be a colloquy of questions that are going to be asked. Let the questions be asked not speeches from the floor.

MR. STEIN: Sir, the other night I was here very late and let only largely representatives of the power companies proceed in their own manner.

I think the admonition is well taken. But the point is that in a workshop such as this we have to remember that where we don't have professionals asking the questions, they have to do this irrespective of their personalities.

I asked you to be brief. If you can I think this would help because I think Mr. Petersen has made an excellent suggestion. And while philosophically, morally, and emotionally I agree with him thoroughly, I don't think in the exercise of my official capacity I can really enforce it.

MR. COMEY: I would only finish the comment I tried to make before, and that was that I did regard your statement that the scientists would be there after 15 years caring about the lake when the public had long gone back to its fun, games and dancers. I find that a very patronizing remark.

DR. McWHINNIE: I do not mean it to be so. I regret that you have taken that interpretation.

MR. STEIN: Are there any further comments or questions?

If not, thank you very much, Professor McWhinnie.

DR. McWHINNIE: I am sorry for the time.

MR. STEIN: It wasn't you.

Now, we have several people here who have filed statements.

Ted Falls, President of the Porter County Chapter, Izaak Walton League, had to leave and will submit a statement next week. (See Pp. 2345-2349)

Mr. Seymour Altman, Commissioner, Highland Park Environmental Control Commission. (See Pp. 2248-2249)

Mrs. Bieker, Indiana Division Board, American Association of University Women. (See P. 2250)

Mrs. S. Troy

And Mrs. Robert McKimpton, Independent Citizens' Water Pollution Research, Inc., Hammond, Indiana. (See Pp. 2251-2254)

They have all submitted statements for the record and without objection they will be entered into the record as if read.

Now, I have a job as an administrator as well as doing this, and sometimes I recognize the force and the reluctance of the scientific community to come up with a figure or a definite answer on something. But when they come in for the grants for a project, they sure want a definite answer from me on what the figures are, and the money they are going to get before they start.

John Berghoff. Is he here?

Mrs. Jack M. Troy.

STATEMENT OF SYLVIA TROY, PRESIDENT, SAVE THE DUNES COUNCIL, MUNSTER, INDIANA

MRS. TROY: I am Sylvia Troy. President of the Save the Dunes Council, a conservation group of 3,000 members, formed in 1952 to establish and protect the Indiana Dunes National Lakeshore.

It will be bitterly ironic if after all the years

(Continued on P. 2255)

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October 2, 1970

Federal Water Quality Administration
Great Lakes Region
Department of the Interior
Chicago, Illinois

Gentlemen:

I am Seymour Altman. I appear here as a representative of the City of Highland Park Environmental Control Commission. I am also a co-chairman of an environmental organization, the Society Against Violence to the Environment, as well as, an individual -- a resident of a community bordering Lake Michigan and in close proximity to the proposed Zion Atomic Energy Power Plant.

We have sat through these days of hearings, with increasing disquietude, as industry has paraded forth an impressive array of very sincere, technicians and engineers -- to show us that it is impossible to prove that adding enormous amounts of heat, albeit dutifully diluted, to our Lake will harm the Lake's environment. We are not certain whether we should be horrified by this nightmare, or whether we are to laugh grimly and treat this as some satirical, existentialist theatrical production. Apparently they would have us all believe that the burden of proof is on the public -- that we must risk further pollution of the Lake now and in the future.

Gentlemen, this summer the residents of Highland Park were made aware of the effects of past pollution of our Lake based on the same premise. Our beaches were closed for swimming. This came as a shock to people who had always considered that they could enjoy the privileges inherent in living in a community on a Lake.

The closing of the beaches, in itself was a worthwhile symptom of the dangers to which our natural surroundings are exposed. We have become increasingly aware of the confluence of pollutants in our area. Add to this pollution large amounts of heat -- what do we get? What is the cynergistic effect on the Lake and on us?

Industry would have us believe that the only way to find the answer is to "try it and see." We have been through that one before. Look where it got us.

The simple and logical answer is this: nothing more in the way of additives which might change the Lake is to be allowed to be introduced into Lake Michigan. This Lake belongs to the people. As such it is our responsibility to protect it and safeguard it. If someone wishes to use it -- they must show, beyond any doubt, that they will not harm it or us. Till such a time, it is our prerogative, and our duty, to prohibit their transgression of our rights.

Sincerely,

Seymour Altman

Seymour Altman

SA:sss

AMERICAN ASSOCIATION OF UNIVERSITY WOMEN
Indiana State Division

October 2 1970

1154 Ridge Road, Munster In
46321

Lake Michigan Enforcement Conference
Sherman House
Clark and Randolph Sts
Chicago, Illinois

Gentlemen:

The Indiana Division of the American Association of University Women wishes to go on record in support of the Department of Interior's criteria for protecting Lake Michigan waters against thermal pollution. This department has shown the most informed interest in protecting the environment in the public good and would be the best informed and dependable in guarding conditions.

We have waited too long for this Conference to bring forth a clear protective policy. We have waited too long for our own state of Indiana to enforce what standards we already have or to support a strengthening of the criteria concerning lake water quality. We see no bright hope in the states surrounding the lake agreeing on a set of standards that would be to their mutual advantage and equal enforceability.

We hope therefore that the regional Directof of the Federal Water Quality Administration will officially designate the Secretary of the Interior and his department as the federal authority establishing federal standards. We would recognize that they would be pressured by heavily weighted vested interests who would gain by freedom to misuse the lake. The Department of Interior has demonstrated that they are capable of acting in the over-all public good and we favor their firm stand on criteria that would not permit lessening quality of the lake water.

Yours sincerely

Helen K Bieker

Mrs. L. W. Bieker
Division Board
Indiana Division
AAUW

FEDERAL WATER QUALITY
ADMINISTRATION
HEARING

Chicago, Illinois
October 2, 1970

prepared by

INDEPENDENT CITIZENS' WATER
POLLUTION RESEARCH, INC.
7616 New Hampshire Avenue
Hammond, Indiana 46323
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The INDEPENDENT CITIZENS' WATER POLLUTION RESEARCH, INC. is a unique non-profit organization in that it was created for more than one purpose. As its name indicates, one of our primary purposes is to sample and analyze waters, both public and private, and to demonstrate the conditions of those waters. Another purpose of our corporation is to keep the public aware of the conditions of waters sampled and analyzed. A third purpose which excludes I.C.W.P.R., Inc. from being strictly an analytical corporation is our efforts to work for more stringent anti-pollution statutes and regulations as a result of our studies and research.

Representatives of our corporation have come in contact with and dealt with governmental agencies such as the Indiana Stream Pollution Control Board, the Federal Water Quality Administration, the Indiana State Board of Health, the Lake County Board of Health, and the Army Corps of Engineers. In each instance in dealing with each of these agencies, we have found an awareness of the severity of the present pollution problems. In each instance in dealing with each of these agencies, we have also found ineffectiveness, evasiveness and lack of direction.

For example, in the state of Indiana, the legislature has established the authority for the creation of the Indiana Stream Pollution Control Board, its powers and regulation of enforcement in statutes 68-517 through 68-543 inclusive. These statutes allow the SPCB to establish and enforce stringent criteria and control of these criteria, but the SPCB has not done so. The SPCB has, instead, adopted weak and inconsistant criteria and regulations. These criteria include Lake Michigan open water, Lake Michigan shore water, Lake Michigan inner harbor basin, Indiana Harbor Canal, Grand Calumet River, Little Calumet River flowing into Illinois, and Wolf Lake. The criteria for these interstate waters were requested and approved by the Department of Interior. No samples to be used for proof of a violation by any entity can be from effluent discharges, but must be from the body of water itself after dilution; but no stipulation is given as to what constitutes a dilution or mixing zone. The substances included in the criteria for thses interstate waters varies so that not all the same substances appear in all criteria lists.

It has been proven that industries, municipalities and individuals have not and will not attempt to reverse their polluting d~~y~~ue to social conscience. The only solution, therefore, is strength in the federal, and subsequently state, agencies responsible for controlling, regulating and enforcing anti-pollution regulations. The government is the only possible means through which the pollution crisis in our country can be solved. Study commissions, conferences and meetings of all types have proven to be mere dead ends from which very little positive action emits.

Public dissatisfaction grows stronger day by day with the ineffectual handling of our deteriorating environment. The governmental agencies, especially the FWQA, must begin immediately to act with more authority. Compromise and ineffectual gestures must cease. The FWQA must require compliance by the states in stiffling the progressive deterioration of our water and air. Ignorance is no longer a valid excuse. The health and welfare of this country's people is now a necessary priority.

The matter of thermal pollution is just another in the long list of pollution sources. The FWQA has the opportunity and the power to halt this source before it is allowed to become another major pollutant.

It is for these reasons stated that INDEPENDENT CITIZENS' WATER POLLUTION RESEARCH, INC. recommends to the Secretary of Interior that the thermal criteria be removed from the Enforcement Conference and placed directly in the authority of the Federal Water Quality Administration as an agency of the Department of Interior.

we labored to secure the National Lakeshore, its 13 miles of beaches will not be usable by the public -- and that is a very real concern. The beaches farther west in Indiana -- at Whiting and Hammond -- have already been closed to public use.

All of Northern Indiana Public Service Company's major electric generating facilities are on the shores of Lake Michigan, despite the fact that the company services the entire northern third of the State. They presently have three plants and propose to build three more -- a total of six utility plants -- on a 30-mile span of Lake Michigan shoreline and five of those plants border land dedicated to public recreational use.

At the proposed Michigan City plant at the eastern end of the Indiana Dunes National Lakeshore, 875,000 gallons of heated water per minute (heated to a maximum of 25 degrees above lake temperature in winter, though the company refers to a 14-degree rise, when 14 degrees is the average temperature) will be discharged adjacent to sewage effluent coming from Trail Creek in Michigan City.

... Slide ...

I do have a slide, a map of the Indiana Dunes National Lakeshore. Harold, would you mind indicating where that Michigan City plant is? The areas in white are the designated areas of the lakeshore.

The currents here move in a westerly direction along the shore and this area has been designated for intensive public beach use. The shoreline erosion in this area is particularly acute. According to the Army Corps of Engineers figures, the erosion rate is 9 feet of shoreline per year and is due primarily to the Michigan City harbor breakwater which disturbs the natural littoral drift. More than 300 lots are underwater and over a mile of road has been washed away in the past year. The heated utilities discharge moving along the shore will most certainly melt or soften the natural ice barrier formed along the shore which normally acts as a protective shield to the ravaging winter and spring storms, aggravating and accentuating an already critical erosion problem.

At the western end of the lakeshore, the Bailly nuclear plant is being proposed. Here, the vast amounts of heated water, trapped by the Bethlehem landfill and joined by the chemical wastes of the Bailly coal-burning plant and other wastes from Burns Harbor will be forced to move in an easterly direction and have a similar melting effect on the protective ice ridges along the shoreline, thereby creating further erosion and pollution problems.

I would like to counter the statistical

contortions of the power industry who are attempting to prove that dumping of vast quantities of heat will not be harmful to the lake -- they even have the effrontery to assert that it may be beneficial -- with the evidence of what is happening to Lake Michigan.

Here is algae collected from the east end of Beverly Shores in the Indiana Dunes National Lakeshore near the Michigan City plant of Northern Indiana Public Service Company. This is a recent development and proof of the acceleration of the eutrophication process. Each year there is more and more of it along the shore.

Have industry scientists explored the synergistic effects of waste heat in shallow water already heavily contaminated with chemical and sewage effluent? Would the electric power industry be willing to post a bond of several million dollars or perhaps a billion dollars to support their assertions that heat will not adversely affect the fishing industry or recreation potential of the lake or deteriorate its quality or disturb its biota?

What is the credibility record of the industries along the Lake Michigan shores? What is the credibility record of the utilities at the southern end of the lake? Twenty years ago when my husband practiced medicine in Whiting, Indiana, and phoned Commonwealth Edison Company

State Line Generating Plant to complain about the air pollution, the officials came to see him and assured him that every possible measure was being taken to clean up their stacks. Last week, finally, the city of Chicago sued Commonwealth Edison for violations. NIPSCO's promises on their Bailly plant were never kept. The dirt plumes are visible 10 miles away.

Lake Michigan would normally have a life span of 25,000 more years. Responsible biologists say the lake may be dead in 15 years if we continue on our present course. And is industry heeding this warning? No. They are pursuing the same destructive, mindless, short-sighted policies and they now propose to use Lake Michigan as a heat sink as well. The quality of Lake Michigan has not improved since 1965. In fact, it may have deteriorated.

Here is the record of Indiana industries since the passage of the Clean Water Act. U. S. Steel Gary Works has actually increased daily discharges of oil. In 1965, they discharged 54,000 pounds of oil daily. Now, 5 years later, supposedly with enforcement procedures under way they have actually increased their discharges to 67,317 pounds of oil daily and they dump 306,781 thousand pounds of suspended solids as well.

Inland Steel Company discharged 23,791 pounds of oil and 103,617 pounds of suspended solids.

The figures for Youngstown Sheet and Tube Company is 11,000 pounds of oil and 46,000 pounds of solids.

Perry Miller of the Indiana Stream Pollution Control Board, ever an apologist for industry, is quoted by Chicago Daily News, August 4, 1970, as admitting industry is still discharging large quantities of oil but says "... these are large facilities and large bodies of water." Ten years ago Blucher Poole refused to be concerned about possible wastes from Burns Harbor.

It is no surprise that the industries and utilities prefer Indiana State standards and State enforcement and object vigorously to Federal interference.

The record of the Indiana Stream Pollution Control Board in reversing water pollution trends in the State is abysmal (with the exception of some recent actions). The conditions of the Grand Calumet and Little Calumet Rivers are as deplorable as ever. Lack of staff and an antiquated and politically controlled judicial system also hamper them. Governor Whitcomb has not acted to request the State Legislature for maximum funding to quality available Federal grants to build needed municipal sewage treatment plants.

Industries prefer to locate in Indiana where they can manipulate and control the local and State regulatory agencies. The extent of air and water pollution in the Calumet region, despite the Federal Clean Air Act and Clean Water Act in 1965, despite local and State laws, is a National scandal and the record of the local and State anti pollution agencies ought to be investigated.

There is an increased awareness by the public of the threat to Lake Michigan as evidenced by the growth and proliferation of conservation groups in Indiana and the attendance of over 1,000 people at the public hearing on the proposed Michigan City NIPSCO plant. We are prepared to take legal action, if necessary, against the State Water Pollution Control Board for failure to protect the public interest.

We wish to applaud the courage and integrity of the Federal Water Quality Administration and the Department of Interior in taking a firm and unequivocal position against thermal discharges into Lake Michigan. The feasibility of alternate methods of cooling with costs that will not be excessive to the public offer no excuse to the utilities for not acting immediately to use this technology. Utilities' threats of blackouts and brownouts is reprehensible. Indeed it reflects their lack of efficiency and organization. They prefer to put the blame on the conservationists.

A vigorous approach is necessary if we are to save the lake.

May we urge the State of Indiana to finally come into the Twentieth Century and approve the thermal criteria as requested by the Department of Interior.

Thank you. (Applause)

MR. STEIN: Thank you, Mrs. Troy.

Any questions or comments?

If not, thank you very much, Mrs. Troy.

Andrew O'Conor.

STATEMENT OF ANDREW J. O'CONOR, ATTORNEY, OF THE FIRM OF BERRY AND O'CONOR, OTTAWA, ILLINOIS

MR. O'CONOR: Mr. Stein, members of the conference, ladies and gentlemen. My name is Andrew O'Conor. I am an attorney, for better or for worse, from Ottawa, Illinois, LaSalle County, which is located approximately 100 miles southwest of where you are sitting.

I am here on behalf of a group known as the Brookfield Township Land Committee; the Illinois Agricultural Association, a group of approximately 190,000 members; the

Illinois National Farmers Organization; the Illinois Farmers Union; the Fox River Valley Community Action Council, which consists of twelve locals of the United Auto Workers from Streater to Woodstock, Illinois; and we are here to present our position which to many of you may seem to be totally unrelated to the thermal pollution of Lake Michigan.

Actually we are here because of what we think is an attempt to avoid thermal pollution of Lake Michigan by the Commonwealth Edison Company, which company services part of the territory which I represent.

The relationship is direct and is caused by their attempt to avoid violating the thermal differential regulation which has been propounded by the Department of Interior, as I understand it, since 1968, and which affects the Illinois River, which is a Federal navigable stream, and which receives into it the Chicago River, waters from Lake Michigan, and the confluence of the Fox or the Kankakee and DesPlaines Rivers to form the Illinois River in our part of the State.

MR. STEIN: This is outside the conference area, isn't it?

MR. O'CONOR: Well, I think it is, Mr. Stein, and in deference to you I did talk to Mr. Wright, and I don't intend to really go beyond this except to -- from Washington message -- and this I mention to you gentlemen and to the people who are here from the various power companies -- I think if you feel that by removing these powerplants from the Lake Michigan shores to an inland site, and thereby at least appear to temporarily solve the thermal pollution of our lakes, you have solved the problem, you are wrong, because you will run into just as vigorous opposition from land-based groups such as I represent unless the selection of the site is compatible with the land use and the land sought to be taken, in terms of what is good land as opposed to poor land. And I would like to just make that point for the conference. I think that is important.

MR. STEIN: By the way, I think I agree with you. I think the way our Federal law is now, if it were ever true in the past, that industry could go from one place to another and avoid tight regulations, it doesn't apply today. I am not just referring to the power industry, because as many industries know -- and I am not sure how well they like to see me -- they find wherever they go in the country, there I am.

MR. O'CONOR: Right, and this is precisely our problem. (Laughter) Not you, particularly, but I mean wherever the power companies go, that is our problem. I didn't mean that in reference to you.

We do feel, though, that before you relocate -- and you take this home -- there is a lot more to just relocating away from Lake Michigan or any of the Great Lakes than simply picking out a site and looking at it from an economic standpoint -- that is from the company's economic standpoint and thinking then that because you have the supposed power of condemnation that all of the people who are interested in this good land are going to surrender. They are not going to do it, and there is going to be some regulations, truly some ground rules laid out about land use in relation to utilities in the future.

MR. STEIN: Thank you very much.

MR. O'CONOR: Thank you.

(The following document was submitted for inclusion in the record by Mr. O'Conor.)

LET'S TELL IT LIKE IT IS!

In view of the confusion about and distortion of the Brookfield Township Land Committee's true position in relation to the Commonwealth Edison project, we herewith submit our position and the reasons therefor. This position and the points supporting it has remained constant and unchanged since the original announcement of the project in the spring of 1970.

1. Apparently some persons are under the impression we desire to force Commonwealth Edison Company to leave this area entirely. Such is not the case nor has it ever been the case. We do desire and insist, however, that Commonwealth Edison Company not use the prime farm land which it now seeks but rather locate the plant and its facilities upon idle, unproductive, or marginal farm land, of which there are thousands of acres in this area, both within and without LaSalle County. In this regard, the original plan of Commonwealth Edison use was to a considerably smaller tract of land (5000 acres) than that now sought and which land was located directly along the south bank of the Illinois River south of Seneca and three miles north of the proposed site. Several thousand acres still remain in this general area which we believe could still be used for the same purpose and which could include a cooling lake. Despite the assertions of Commonwealth Edison Company that it can not use this type of land, engineering advices indicate otherwise. Full engineering plans were and are drawn for this original site. The land taken at Dresden, both for the first nuclear plant as well as for the second nuclear plant, is for the main part highly marginal, unproductive land. The same poor land quality and characteristics prevail in large part in the Lake Kincade area and we are informed the same marginal quality of land is

sought to be taken in the Cordova, Illinois area near the Quad-Cities. The Brookfield Township Land Committee acknowledges the need for additional electrical energy. This statement has been made repeatedly to Commonwealth Edison Company and to the public generally. We are, however, unalterably opposed to the taking of prime farm land for the present proposed site and further oppose ~~proposed~~ future similar takings of prime and good farm land, which "must" be taken according to the utility industry press releases, literature and projections. If this is so, why was the poor quality of land taken at Dresden, Cordova and Kincade? On the contrary, there is in fact available to the utility industry literally tens of thousands of acres of idle, unused and unproductive land which can, through modern engineering techniques, be adapted to and for the construction of the nuclear energy plants and facilities. Since the initial Commonwealth Edison Company announcement was made in early spring, the Commonwealth Edison Company has repeatedly stated that "its studies" and "its engineering research" indicate that none of the tens of thousands of acres of idle, unproductive lands in this area or, in fact, throughout all of Illinois - which they have allegedly reviewed and surveyed - are adaptable or useable for nuclear energy plant sites. This we deny. Repeatedly, our group, through its attorney and its various representatives, has asked the Commonwealth Edison engineers to release and reveal all of their so-called in depth engineering studies and data to permit us and our engineers to analyze such data and research. Not once has Commonwealth Edison as yet responded to such a request. We again challenge them ~~again~~ to here and now release this information immediately so that we and all who are interested in the agricultural industry might have an adequate and fair opportunity to thoroughly analyze and inquire into the Commonwealth Edison studies. The only answer we have received from Commonwealth Edison engineers when such requests have been made is "we are sorry, we can not release this information at this time. Eventually you will receive it". Eventually, why not now? We ask you, Commonwealth Edison, to play fair with us and all of the agricultural industry and release all of your studies immediately! Actually most of the Illinois Valley area from a point immediately west of Seneca on through west of LaSalle and Peru is all served by the Illinois Power Company. It is a known fact that the electric power sought to be generated at the Brookfield site will not be used here but will be transmitted to the City of Chicago and the Cook County area. We have no fear that Commonwealth Edison will leave this area if they are required to put this plant on idle, less productive ground. Commonwealth Edison has every intention of being in on the "economic kill" of this valley when it develops.

2. About the suggested job loss to this community: If this plant is removed to the original site proposed for it by Commonwealth Edison, to-wit, some three miles north of the Brookfield site or to some other site in this area, no jobs will be lost. Obviously, the jobs will still be there and the economy of this community will in no wise be effected. Persons regularly travel many miles daily to their regular places of employment, i.e., Caterpillar-Aurora, Caterpillar-Joliet, to Owens-Illinois at Streator from Ottawa, and from Libbey-Owens-Ford at Ottawa from Streator, etc. Moreover, there might well be more jobs created should Commonwealth Edison Company abandon the cooling lake project and invoke one of the several alternatives available to them as suggested by the Department of the Interior of the United States Government, to-wit:

A. Dry cooling towers,
B. Wet cooling towers, or
C. Spray canals.

While Commonwealth Edison has only casually referred to these alternatives, they do exist and, in fact, are successfully in use in dozens of places, not only in the United States but throughout the world. They have proven satisfactory and are constantly being constructed in lieu of and in preference to cooling lakes.

Cooling ponds are objectionable in the following major particulars:

A. Cooling ponds by their very nature have a low heat transfer rate and thereby require large surface areas - they have been considered by numerous engineering authorities to be impractical.

B. The quality of cooling pond waters will decrease with time as solids left behind by evaporation accumulate.

C. Cooling ponds by the nature of their construction concentrate dissolved solids.

D. Cooling ponds further collect impurities since large surfaces are open to the atmosphere.

The primary reason for cooling ponds is because they are one of the cheapest and least expensive methods of water cooling. Any environmental contribution is purely secondary and incidental to their primary purpose and use.

3. Much is said about tax loss. Actually, there would be no tax loss but a tax revenue gain if Commonwealth Edison were to build on the idle or marginal land. three miles to the north of the proposed site or were to build on idle, marginal land located elsewhere in LaSalle County. Remember Commonwealth Edison also owns large acreage in the Utica area. Much of this acreage is idle and unproductive.

Should Commonwealth Edison build on marginal land:

A. The new plant and plant site would be located on marginal land now producing very little tax revenue, and this in turn would become high tax revenue producing land.

B. The present highly productive and highly taxed prime farm land in Brookfield Township would still be available for present and future taxation and would continue to contribute its regular tax share.

4. About the right of condemnation or the taking of the land: We have been advised by many of the land owners and tenants that certain of the Commonwealth Edison land agents have indicated that the company has the absolute right of condemnation and that if the land owners and tenants do not agree to the prices and propositions presently being offered by Commonwealth, they will receive less at some future condemnation hearing date than the prices and propositions now proposed. Such statements are absolutely false. Neither the Commonwealth Edison Company nor any utility in Illinois, has the absolute right of condemnation. The Illinois Public Utilities Act, under which Commonwealth Edison must file its application for a Certificate of Convenience and Necessity, requires the concurrent action of the petitioning public utility and the Commerce Commission to vest the power of eminent domain. Commonwealth Edison does not have the right of eminent domain under this act until and unless the Commission issues its certificate finding that the public convenience and necessity exists for the facility. Before any action is taken by the Commission extensive public hearings must be held under the law and will be held before the Illinois Commerce Commission. If adverse to the Brookfield Group, the decision will be taken through the entire appellate court system of Illinois for adjudication. The final determination of whether or not the power of condemnation, in fact, will be granted is at least two or more years away and possibly

considerably longer. For authority that Commonwealth Edison does not have the power of condemnation, we refer you to the case of Central Illinois Electric & Gas Co. v. Scully, 161 N.E.2d 304, at page 307, wherein the Supreme Court of Illinois (1959) recited as follows:

> "The necessity for the improvement requiring condemnation and the manner of its construction are for the consideration of the condemnor, subject to the decision of the commission as to convenience and necessity. The condemning petitioner does not have the right of eminent domain until the commission issues its certificate".

We challenge Commonwealth Edison and its counsel to contradict this holding of law announced by the Illinois Supreme Court in the above case and which law governs today. Commonwealth Edison has been totally silent on this point. Don't be mislead by statements to the contrary!

5. The effect of deep wells on the surrounding territories not taken: Commonwealth Edison admits it must sink numerous deep wells in the area to supply the pure water needed for steam generating purposes. Tens of thousands of gallons of pure water will be needed twenty-four hours every day, 365 days a year. This fact is not in dispute and is conceded by Commonwealth Edison. The present average well depth in Brookfield Township is now approximately 600 feet. Water is consistently and regularly available at this level to Brookfield Township residents for all purposes. Commonwealth Edison says it will take water from deep well veins. All well enough! In recent years industries locating near Ottawa and Seneca who likewise take extremely high gallonages of water daily from deep vein levels made the same statement before sinking their wells. Ask the farm and city residents who live in northwest Ottawa and beyond in the country, as well as in the Village of Seneca, Manlius Township and parts of Grundy County, what happened to their relatively shallow depth wells once industries started

tapping the deep vein wells in these areas. You've guessed it! Their wells went dry. Consider also the disastrous effect on raising livestock, to say nothing of human needs should this occur! Commonwealth has been totally silent on this point.

6. The effect of the site and its facilities upon drainage in Brookfield Township: The area proposed to be taken presently contains approximately forty percent of the total tiling systems of the entire Brookfield Township area; Commonwealth Edison Company personnel have stated unequivocally that all drainage tiles proceeding through this area will be permanently cut and terminated; that the number of tiles proceeding through this territory is, in fact, unknown both as to quality and quantity and that for a long time subsequent to the installation of this project there will be a severe and substantial backing up of underground drain waters and permanent flooding of lands not to be taken but presently under cultivation surrounding the perimeter of the proposed site. Without question this constitutes a serious and permanent threat to approximately an additional 2,000-3,000 acres of land adjoining the perimeter of the site proposed to be taken. Based upon competent engineering advice, this committee believes that regardless of the technological efforts made by Commonwealth Edison Company, it is both an engineering and physical impossibility to keep the entirety of the perimeter of 2,000-3,000 acres from being permanently flooded and destroyed for cultivation to a greater or lesser extent. Commonwealth Edison has been totally silent on this subject.

7. About Lake Brookfield: Again much has been said regarding the recreational and conservational value of the proposed Lake Brookfield. We invite you to examine and consider just what Lake Brookfield will consist of. Firstly, it will average about 10 feet in depth. It will average 95 degrees water

temperature. It will be filled with whole, "live", untreated Illinois River water. The Illinois River water contains a high percentage of human and industrial sewage particulate as well as a high brine content despite treatment processing. The Illinois River further contains a high content of phosphate and nitrates. Lake Brookfield will have a system of channels separated by numerous dykes which will protrude above water. We are advised Lake Brookfield will not be a solid uninterrupted mass of water from one shore line to another in any direction. It will resemble water canals as in strip mine diggings. Lake Brookfield will evaporate an estimated 96,000 tons of pure water every 24 hour period at an average annual water temperature of 95 degrees - guess what will be left after normal evaporative losses have been added to the high heat induced losses? Right - you guessed it!

How recently have you enjoyed a refreshing swim in the Illinois River water? How recently have you enjoyed fishing in the Illinois River, plus the further pleasure of eating the clean, wholesome fish you have caught? How recently have you enjoyed the delightful aroma from the Illinois River? How recently have you noticed the green algae scum that forms on both the Illinois and Fox Rivers during the summer months when the water reaches a warm temperature point? Bear in mind this "lake" water will be totally untreated and will average approximately 95 degrees annually.

In this connection, it is interesting to note a letter recently written by Mr. Thomas G. Ayers, President of Commonwealth Edison, under date of July 31, 1970 to Mr. Daniel N. Beal, Cashier of the Verona Exchange Bank, Verona, Illinois, wherein he states and we quote him directly:

> "..... The original water to fill this lake will come from the Illinois River and the daily evaporative loss will be made up from the river.
>
> Because the Illinois River is biologically impure, we are not sure at this point what level of aquatic life the lake will be able to support. ...."

And what about Lake Kincade which Lake Brookfield is supposed to duplicate? Lake Kincade is fed by three natural pollution-free water courses. It was formed as a result of a dam on Clear Creek about a mile upstream from the south fork of the Sangamon River. It has an average depth of ________ feet. Because of its low pollution content, it is able to support aquatic life. However, at certain low water seasons of the year there are extensive mud flats adjoining the perimeter of Lake Kincade which prevent people from reaching any of the waters thereof. The average annual temperature of the water of Lake Kincade we are told is 45 degrees to 50 degrees because Lake Kincade receives the discharge waters from the Commonwealth Edison Kincade power station which is FOSSIL FUELED AND NOT NUCLEAR FUELED. Fossil fueled plants discharge about 50% less heat per kilowatt than nuclear power plants. The two lakes are in no way comparable.

8. About the alternatives to a cooling lake: Commonwealth Edison as well as all utilities have been aware for years about cooling towers, both wet and dry, as well as spray canals. The United States Government, through the Department of Interior, recommends the use of dry cooling towers or spray canals. We would be pleased to hear from Commonwealth in this regard. It is a known fact that cooling towers require no fan operating power, occupy a fraction only of the ground space required for cooling lakes, reduces hot and cold water piping costs, generate no noise, and discharge their steam or vapor at a high level.

We quote from "Cooling Tower Newsletter", Number 4, issued April, 1968, published by Research-Cottrell, Inc., Harmon Cooling Tower Division, P. O. Box 750, Bound Brook, New Jersey, as follows:

> "For extremely large installations such as power generating stations, natural draft towers should be considered. These have significantly higher initial cost than mechanical draft units, but they require no fan operating power, they occupy substantially less ground space, they reduce hot and cold water piping costs, and they offer minimum maintenance over a long service life. In addition, they generate no noise, and also discharge the steam plume at a significantly higher elevation, thus eliminating the problems of low level fog and drift."

9. Commonwealth Edison claims there will be little or no fog arising from Lake Brookfield during cooler or cold weather. You don't have to be an engineer to appreciate the fog potential Lake Brookfield will contribute for many miles to the surrounding territory. Based upon engineering advices serious air pollution conditions may arise throughout the year which will effect a substantial number of lands and acreages within a several mile distance of said lake site, causing fog, mist, general air pollution, and all of which will further effect and produce abnormal weather conditions, thus possibly adversely effecting the cultivation of large areas surrounding the proposed lake site. None of these points have ever been discussed by Commonwealth Edison Company.

10. Regarding the economic loss to the community: The entirety of the 7,040 acres proposed to be taken, with the exception of the area taken for easements for roads and natural waterways, is highly productive and superior farm land, is rated as Number 1 or prime farm land for eighty percent thereof, and rated as Number 2 or good farm land for twenty percent thereof; that the records and statistics of production of farm products of all kinds, including livestock, grain, and allother farm items produced by this agricultural community approximates one

and one-half to two million dollars worth of retail value annually; the value of all products and services consumed and purchased by the Brookfield Township group, as a direct result of the agricultural and retail economy produced by this area approximates $700,000 annually.

The area proposed to be taken directly produces approximately 700,000 bushels of feed grain annually, together with 2,000 head of livestock annually, all for public consumption. It is a fact that food shortages can and do repeatedly develop throughout the world and that the present rate of soybean and corn consumption on both the national and international market has soared to thirty to forty percent within the last six months alone to say nothing of the serious corn blight loss problem we are now faced with. The actual feed grain reserves of this country do not constitute in excess of one year's supply as dictated by the needs of the national economy and will be further shortened and reduced according to some agronomists.

That annually more than one million acres of land are now taken out of production in this country due to developments of one sort of another, i.e., highways, house and building construction, and the like; that our population continues to expand and soar and is looked upon as one of the grave issues not only for the present but in the future as well; highly productive andsuperior producing Number 1 farm land should not be taken out of permanent production when other totally nonproductive and idle lands available by the thousands of acres can and could be utilized for nuclear energy site facilities. ONCE THIS LAND IS TAKEN IT WILL BE TOTALLY AND PERMANENTLY REMOVED FROM PRODUCTION FOREVERMORE AND WILL, IN FACT, MOREOVER PERMANENTLY ADVERSELY EFFECT A SUBSTANTIAL ADDITIONAL ACREAGE SURROUNDING AND ADJOINING THE SITE.

11. Just what kind of land is Commonwealth Edison proposing to take in Brookfield Township? Much has been said about the average or inferior type of land proposed to be taken. Nothing could be further from the truth. Of all of the 7,000 acres proposed to be taken not one acre is in the soil bank. Approximately   acres is in what is known as the Federal Farm Program. This program is entirely distinct and separate and is formed for totally different purposes. This is a year to year program and is designed to balance supply and demand and to keep in reserve a sufficient acreage for future food needs of this country. This reserve, which has long been a factor in American agriculture, is no different from the electrical energy reserve Commonwealth Edison hopes to acquire for electric energy users. It is simply a sensible way of controlling highly productive farm land and has long been recognized by agricultural experts as a method of insuring adequate food supply for the nation at all times.

80% of the land proposed to be taken is classified as Number 1 farm land by the United States Department of Agriculture. Number 1 farm land is defined as land which will raise a minimum of 125 bushels of corn per acre with an expenditure of not to exceed $20.00 per acre for fertilizer, and would raise a minimum of 40 bushels of soybeans per acre. The remaining 20% of the land proposed to be taken is classified as Number 2 farm land by the United States Department of Agriculture. Number 2 farm land is defined as land which will produce not less than 100 bushels of corn, with an expenditure of not to exceed $20.00 per acre for fertilizer, and produce not less than 35 bushels of soybeans per acre.

To remove all doubt on this point we are indebted to Mr. Truman Esmond, a local realtor for many years, and who has been the chief architect and representative of Commonwealth Edison in attempting to acquire the land in question. In an interview with Mr. Esmond taken on February 26, 1970 by Joan Hustis of the Daily Times under the lead title "Huge Land Acquisition Proposal Under Study", Mr. Esmond had this to say about the character and quality of the land he and the other land representatives of Commonwealth Edison now dispute:

> "About 7,000 acres, or almost 11 sections, of "prime farm land" are involved in the proposal, according to Truman Esmond, the local realtor representing the corporation."

LET'S TELL IT LIKE IT IS!

Who is for the Brookfield Group? To name a few:

The First Presbyterian Church of Grand Ridge, Illinois,
United Methodist Church of Ransom, Illinois,
Brookfield Presbyterian Church of Marseilles, Illinois,
St. Mary's Roman Catholic Church of Grand Rapids Township,
St. Patrick's Roman Catholic Church of Ransom, Illinois,
Illinois National Farmers Organization,
Illinois Farmers Union
Fox River Valley Community Action Council, consisting of United Auto Workers Locals 145, 184, 285, 872, 881, 904, 922, 954, 1030, 1088, 1175 and 1615, consisting of 8,000 members in locals from Woodstock to Streator, Illinois,
First National Bank of Grand Ridge, Illinois,
Cooperative Grain & Supply Co.,
Laurence Gage, Ruth Gage, Michael Kennedy, Velma Kennedy, Max Ugolini, Coleen Ugolini, Charles O'Laughlin, Geraldine O'Laughlin, John Looft, Cyrus Trowbridge, John Ryan, Louise Ryan, Paul Ryan, Cyril Ryan, Helen Ryan, Joseph Heaton, Mabel Heaton, Larry Heaton, William Heaton, Jerome Heaton, Roy Spaulding, Robert Gage, Doris Gage, William Ross, Lois Ross,
Plus an additional 5,000 people who have signed our petitions in the last 90 days.

Respectfully submitted,

BROOKFIELD TOWNSHIP LAND COMMITTEE

By Ruth Gage, Laurence Gage
Mary Ann Muffler, Donald Muffler
Jean Widman, Mark Widman, Jr.
Michael Kennedy, Velma Kennedy
Max Ugolini, Coleen Ugolini
William Ross, Lois Ross
John Looft, Ruth Widman, and
Robert Widman, Co-Chairmen

KEEP THE FIELDS IN BROOKFIELD!

Statement Brookfield [illegible] LaSalle County Illinois

2279

ILLINOIS COMMERCE COMMISSION,
On its own motion

vs.

COMMONWEALTH EDISON COMPANY POWER COMPANY, CENTRAL ILLINOIS UNION ELECTRIC COMPANY, ILLINOIS PUBLIC SERVICE COMPANY, CENTRAL ILLINOIS LIGHT COMPANY, IOWA-ILLINOIS GAS & ELECTRIC COMPANY, ELECTRIC ENERGY INC., INTERSTATE POWER CO., MT. CARMEL PUBLIC UTILITY COMPANY, PEOPLES GAS LIGHT & COKE COMPANY, and NORTHERN ILLINOIS GAS COMPANY.

Investigation of Air Pollution in the State of Illinois so far as Illinois Public Utilities are involved.

55321

Filed with [illegible] July [illegible]-1970

PETITION TO INTERVENE

Now comes the First Presbyterian Church of Grand Ridge, Illinois, United Methodist Church of Ransom, Illinois, Brookfield Presbyterian Church of Marseilles, Illinois, St. Mary's Roman Catholic Church of Grand Rapids Township, LaSalle County, Illinois, St. Patrick's Roman Catholic Church of Ransom, Illinois, Illinois National Farmers Organization, Illinois Farmers Union, Fox River Valley Community Action Council, consisting of United Auto Workers Locals 145, 184, 285, 872, 881, 904, 922, 954, 1030, 1088, 1175, and 1615, First National Bank of Grand Ridge, Illinois, Cooperative Grain & Supply Co., Laurence Gage, Ruth Gage, Caroline Whittaker, George Whittaker, Lillian Briner, Henry Briner, Gladys Hallowell, Clifford Hallowell, Michael Kennedy, Velma Kennedy, Kathryn Fleming, Margaret Carey, Max Ugolini, John Kennedy, Helen Kennedy, Stacia Hynds, Hugh Killelea, Mary Danaher, Charles O'Laughlin, Geraldine O'Laughlin, James Kennedy, John Budach, William Bieneman, George Looft, John Looft, Cyrus Trowbridge, Walter Chrest, George Chrest, Florence Marsh, Dominic Ugolini, Arlene Ugolini, Ronald Briner, Caroline Briner, Emmet Kennedy, Margaret Kennedy, Edwin Morrow, Donald Muffler, Mary Ann Muffler, John Ryan, Louise Ryan, Paul Ryan, Cyril Ryan, Helen Ryan, Robert Carey, Emmett Moran, Carrie Moran, Joseph Heaton, Mabel Heaton, Larry Heaton, William Heaton, Jerome Heaton, Roy Spaulding, Ronald Frye, Rose Frye, Luella Beacher, Mildred Myers, Thomas James, Benoit Hallett, Marjorie Hallett, John Feidler, Nancy Feidler, Margaret Kennedy, Robert Gage, Doris Gage, David Bedeker, Darlene Bedeker, Raymond Bedeker, Elizabeth Bedeker, Carrie Lou Cleve, Forrest Cleave, Caroline Gage, Melva Gage, Edward Caputo, Venita Caputo, William Ross, Lois Ross, Kenneth Edwards, Parnell Maier, Anna Maier, Elmer Maier, Felicia Maier and Orel Logsdon, by Berry & O'Conor, their attorneys, and petitions this Commission for leave to intervene in the instant proceeding and in support of their position, allege as follows:

1. The various petitioners above named and described are landowners, tenants and other persons, religious and lay organizations and groups either residing within or residing closely without and on the perimeter of the territory proposed to be taken by Commonwealth Edison Company of Chicago, Illinois for a nuclear energy generating plant site in Brookfield Township, LaSalle County, Illinois. All of said persons, corporations, organizations and groups have organized to promote and maintain the present and long-standing environmental quality of agricultural and environmental life which has prevailed in Brookfield Township, LaSalle County, Illinois since its development as a highly productive and highly valuable farm community and center for over 100 years last past. These petitioners represent to the Illinois Commerce Commission that they will all be subjected to a permanent and total change in environmental land use and development both within and without the area effected if the taking of said land is permitted, for the following reasons:

A. The entirety of the 7,040 acres proposed to be taken with the exception of the area taken for easements for roads and natural waterways for highly productive and superior farm land is rated as Number 1 or prime farm land for eighty percent thereof, and rated as Number 2 or good farm land for twenty percent thereof; that the records and statistics of production of farm products of all kinds including livestock, grain, and all other farm items produced by this agricultural community approximates one and one-half to two million dollars worth of retail value annually; that the value of all products and services consumed and purchased by the above persons, organizations, and entities, all of whom are from the Brookfield Township community, as a direct result of the agricultural and retail economy produced by this area approximates $700,000.00 (seven hundred thousand dollars) annually.

That the area proposed to be taken directly produces approximately 700,000 bushels of feed grain annually, together with 2,000 head of livestock annually, all for public consumption. That it is a fact that food shortages can and do repeatedly develop throughout the world and that the present rate of soybean and corn consumption on both the national and international market has soared thirty to forty percent within the last six months alone. That the actual feed grain reserves of this country do not constitute in excess of one year's supply as dictated by the needs of the national economy.

That annually more than one million acres of land are now taken out of production in this country due to developments of one sort or another, i.e., highways, house and building construction, and the like; that our population continues to expand and soar and is looked upon as one of the grave issues not only for the present but in the future as well; that highly productive and superior producing Number 1 farm land should not be taken out of permanent production when other totally non-productive and idle lands available by the thousands of acres can and could be utilized for nuclear energy site facilities; that once this land is taken it will be totally and permanently removed from production forevermore and will in fact adversely effect a substantial additional acreage surrounding and adjoining the site.

B. That immediately to the north and adjoining this property lies approximately 5,000 acres of rough, unproductive land, a large portion of which is already owned by Commonwealth Edison Company; that this land is, in fact, available to the Commonwealth Edison Company and its availability as an alternate site should be considered and inquired into in depth by the Illinois Commerce Commission in connection with its general inquiry into this subject matter.

That to date hereof the Commonwealth Edison Company has refused to reveal its engineering data or studies as to the feasibility of developing this alternate site or any other alternate site, except by general statements indicating increased costs would ensue but without divulging any particulars. It is the opinion of these petitioners, based upon competent engineering consultation and advice, that in fact, the 5,000 acre tract adjoining to the north could be equally utilized and developed for identical atomic energy producing purposes; that the 5,000 acres of rough, unproductive land to the north produces little or no agricultural products, is largely idle, and could well be utilized as an energy producing site; that a visual inspection and comparison of the two areas clearly reveals a total and complete distinction in soil fertility and productive capacity and quality.

C. That the area proposed to be taken presently contains approximately forty percent of the total tiling systems of the entire Brookfield Township area; that Commonwealth Edison Company personnel have stated unequivocally that all drainage tiles proceeding through this area will be permanently cut and terminated; that the number of tiles proceeding through this territory is. in fact, unknown both as to quality and quantity and that for a long time subsequent to the installation of this project there will be a severe and substantial backing up of underground drain waters and permanent flooding of lands not to be taken but presently under cultivation surrounding the perimeter of the proposed site. That this constitutes a serious and permanent threat to approximately an additional 2,000 acres of land adjoining the perimeter of the site proposed to be taken. That based upon competent engineering advice, these petitioners believe that regardless of the technological efforts made by Commonwealth Edison Company, it is both an engineering and physical impossibility to keep the entirety of the perimeter of 2,000 acres from being permanently flooded and destroyed for cultivation to a greater or lesser extent.

D. That these petitioners have further been informed that the surface of the lake area will constitute approximately 4,500 acres; that the temperature of the water being emptied into this lake, after cooling the generators to be located on the proposed site, will vary between 70 and 110 degrees; that by reason thereof these petitioners state, based upon competent advice and counsel, that serious air pollution conditions may arise throughout the year which will effect a substantial number of lands and acreages within a several mile distance of said lake site, causing fog, mist, general air pollution, and will further effect and produce abnormal weather conditions, thus, adversely effecting the cultivation of large areas surrounding the proposed lake site.

E. That these petitioners further state that the Commonwealth Edison Company proposes to take from the Illinois River tens of thousands of water a day and that this water, which contains a substantial percentage of salt and sewage, will be pumped into the proposed lake in the middle of the farm community of Brookfield Township. That engineering estimates indicate some 60,COO tons of water will evaporate daily from this lake site and that since mainly clean water will evaporate, the brine and sludge particles pumped from the Illinois River will remain behind and settle in the lake; that by reason thereof opprobrious odors may well result and that further the environmental quality of the lake will be seriously reduced and hampered due to the resulting sludge and brine condition.

F. That to supplement the water supply to be taken from the Illinois River, the Commonwealth Edison Company intends to put down numerous deep wells to pump thousands of gallons of water a day from the basic water table underlying all of Brookfield Township; that although the Commonwealth Edison Company proposes to draw water from a deeper level than that presently serving Brookfield Township, repeated similar deep well drawings heretofore carried out by other industries in other parts of LaSalle County have conclusively shown that the current water levels used for general consumption by the public of this area located at 300 to 500 to 800 feet sublevel in these other areas have been greatly effected and depreciated by such other deep level withdrawals of water. That, accordingly, these petitioners believe the value of the remaining land will be greatly reduced throughout all of the township despite precautions and engineering techniques Commonwealth Edison Company might introduce as to this factor.

2. These petitioners further state that, in their opinion and based upon competent engineering advice, it is technically possible for Commonwealth Edison Company to locate their proposed nuclear

generating site upon and within the 5,000 acres of rough and unproductive land located immediately north of the proposed site or upon other unproductive lands located elsewhere in the State of Illinois and thereby significantly and totally remove all of the environmental loss which must and will ensue to the Brookfield Community if the Commonwealth Edison Company is permitted to obtain the proposed site.

3. The Illinois Commerce Commission has the responsibility and power to protect the public safety and environmental welfare by ordering the Commonwealth Edison Company to remove and relocate its proposed site to either the site immediately north and which is presently available to it or to some other site within the State of Illinois; that, in fact, the Commonwealth Edison Company has used lands of extremely inferior value, being those located in Christian County, Illinois for their electrical generating site near Kincade, Illinois; that further, in fact, the land heretofore used and presently being used by Commonwealth Edison Company at its Dresden, Illinois plant located outside of Morris, Illinois, is inferior land and of extremely poor quality, none of which is in any way productive or comparable with the Brookfield Township properties proposed to be taken; that, in addition, the site proposed to be used by Commonwealth Edison Company for its plant located near the Quad-Cities, at Cordova, Illinois consists of very sandy type soil and is of thin and marginal quality and productiveness. That, in addition, to the rough site located to the north and presently available to Commonwealth Edison Company, there are literally thousands of acres of rough and unproductive land located throughout the State of Illinois upon which all of such proposed site could be located. These petitioners state that current costs of transmission are no longer a factor as witness the Kincade plant and Quad-Cities plant, independent

engineering counsel also confirms this. Accordingly, there is available to Commonwealth Edison Company a multitude of sites which should be considered and inquired into by the Illinois Commerce Commission.

4. These petitioners further state, based upon the literature available to them and published by the utility industry, that it is the proposal, not only of Commonwealth Edison Company, but of other utilities to install throughout all of northern Illinois plant sites located upon similar land and that presumably 7,000 to 10,000 to 12,000 acres of farm land comparable to that proposed to be taken will be needed for each site. That, accordingly, the proposed Brookfield Township taking is indeed significant and will set a precedent not only for this particular area but for the entire State of Illinois and these petitioners respectfully and urgently request the members of this Commission to make full and due inquiry in all particulars and thus meet its responsibility to these petitioners and to the public.

WHEREFORE, these petitioners request leave to intervene in this proceedings and to be treated as parties to this proceeding and ask the Commission to grant the following relief:

A. To order Commonwealth Edison Company to utilize existing technology to the maximum feasible extent in relocating its proposed nuclear energy site upon unproductive and unfertile land lying idle and having no agricultural value, and

B. That the Illinois Commerce Commission expand its inquiry on its own motion under and within its investigative docket to include all activities of all Illinois utilities which might create or cause deleterious effects upon or to agricultural and all other environmental land uses as the same are subjected to utility uses from time to time.

C. Require the Commonwealth Edison Company to show that it has exhausted all reasonable and proper alternatives to the proposed Brookfield site.

D. That it deny to the Commonwealth Edison Company any use whatsoever of the proposed Brookfield site for nuclear energy generating purposes.

E. To grant such other relief as will protect the health, safety, agricultural and ecological environment of the Brookfield Township area and the citizens thereof.

Respectfully submitted,

BERRY & O'CONOR,
Attorneys for Petitioners,

By

STATE OF ILLINOIS)
) ss.
COUNTY OF LASALLE)

VERIFICATION

ANDREW J. O'CONOR, being first duly sworn upon oath, deposes and states that he has read the foregoing petition by him subscribed and that the matters therein alleged are true and correct to the best of his information and belief.

Andrew J. O'Conor

Subscribed and sworn to before me
this 11th day of August, 1970.

Veronica L. Boyle
Notary Public

BERRY & O'CONOR
Attorneys for Petitioners
130 East Madison Street
Ottawa, Illinois

Telephone: (815) 434-6206

MR. STEIN: I have a statement from an old friend of the conferees, I guess, John Chascsa, Lake Erie Cleanup Committee, and I would like to put it in the record as if read without objection.

(The statement above referred to follows on Pp. 2289-2290.)

MR. STEIN: Do we have Frederick M. Brown?

David D. Comey? He was here before. There he is.

STATEMENT OF DAVID D. COMEY, DIRECTOR, ENVIRONMENTAL RESEARCH, BUSINESSMEN FOR THE PUBLIC INTEREST, CHICAGO, ILLINOIS

MR. COMEY: Mr. Stein, a funny thing happened to me on the way to the conference. A couple of weeks ago I wrote to Mr. Klassen and asked if I could appear today, and I didn't get an answer from him. But yesterday his secretary called my secretary and said that I should be prepared to testify at 9:30 a.m., Tuesday, October 6, and I find when I come here today that, alas, we are not scheduled.

So since I have taken so much time already today, I would like with your permission to submit a written

Mr. Stein - Won't [illegible] enter this statement of the Lake Erie Cleanup Committee, Inc. as submitted by John Chasca, President.

([illegible])

September 23, 1970

Lake Michigan Enforcement Conference
Sherman House
100 West Randolph Street
Chicago, Illinois

Attention: Chairman, Murray Stein, Chief Enforcement Officer
Interior's Federal Water Quality Administration

Dear Mr. Stein:

It is indeed encouraging to learn that all types of Pollution are being investigated by your Committee.

We have, on many occasions, heard that one type of waste after another is responsible for the condition of our Lakes, Rivers and streams. In some instances we have condemned the use of our waters as dumping grounds or hiding places for unwanted waste sewage, refuse and hot water from large Industries. However, it took our President, Richard M. Nixon to open our eyes to the serious dangers involved in permitting Thermal Pollution to further complicate our Environmental problems. So, if Biscayne Bay can become a living mass of Algae interspersed with dead and dying marine and bird life, this could and would create a very nauseating stench in the area, (which by the way is the location of our Southern White House, it isn't used much, but it is there.) You can imagine what could happen to Lake Michigan, Lake Erie or for that matter any of our inland Lakes. Lake Michigan is the most vulnerable though, and then Lake Erie.

Lake Michigan from Muskegon to Gary, Indiana, and then on to Chicago is (as you know) the natural pocket with no place for the water to flow. This area has for many years received all sorts of waste, it has been the cause of many illnesses, much fish and wild fowl mortality, and could become a hot bed of more of the same, if permission to use Lake Michigan were granted to cool industrial or municipal hot water.

Why must the general Public have to accept the loss of the use of a Public Lake, Stream or River, and be expected to pick up the tab for cleaning up the mess when it becomes too unbearable?

There are, as you have pointed out, many ways to cool and purify water and there are some that have not even been considered.

page 2
Mr. M. Stein
Sept. 28, 1970

Perhaps the state of Michigan's Fisheries Department are expecting to use the warmer water to escalate the growth of the Coho that is being planted by them, or perhaps this is a good way to get a ready cooked meal.

Seriously, the Lake Erie Cleanup Committee supports your stand on prohibiting the use of our Lakes as a depository of Thermal Pollution, or any other form.

Knowing the area around Ludington, I would suggest that these combined systems be used - such as an inland cooling Pond with spray and return canals for re-use in the plant or into the Lake.

Due to unforseen circumstances I am unable to attend this conference, but would like to take this opportunity to voice the opinion of the Lake Erie Cleanup Committee, and the Monroe County Rod and Gun Club, and to thank you for this presentation.

For a better Environmental tomorrow, I remain.

Sincerely,

John Chascsa

John Chascsa, President
Lake Erie Cleanup Committee, Inc.

cc: Conferees: Illinois Environmental Protection Agency,
Wisconsin Department of Natural Resources,
Indiana Stream Pollution Control Board,
Michigan Water Resources Commission

statement to be entered into the record at a later time.

MR. STEIN: Can you get that in next week?

MR. COMEY: I will get it to you by Tuesday.

MR. STEIN: It will be included in the record.

MR. COMEY: Thank you very much.

MR. HARPER: Mr. Stein, since this gentleman --

MR. STEIN: Come on up here. We can't hear you.

MR. HARPER: I am John D. Harper, and I would like to know what this gentleman's testimony will relate to next week. I want to know if I am going to be missing anything as to what particular line of thought he has on this. I wonder if he could just very briefly -- since he has previously expressed himself -- if he could very briefly just encapsulate a couple of his views. Would you be kind enough to do this? This is with your permission.

MR. STEIN: Oh, surely, he can respond to this if he wishes.

MR. FETTEROLF: May I ask who Mr. Comey represents?

MR. COMEY: I am representing Campaign Against Environmental Violence, a Chicago not-for-profit corporation organized in April 1969.

MR. STEIN: I guess I might have read that. Do you want to respond or not?

MR. HARPER: I can appreciate that off the cuff it may be difficult, but it would be appreciated if you could just encapsulate somewhat briefly your views while we are all present.

MR. COMEY: Well, briefly what I was going to talk about, Mr. Harper, was that it is my feeling that the time for research and for study is past. I think -- I won't say is past, but with respect to setting a thermal criterion for Lake Michigan, at the present time, I think it is past.

I think that at the present moment the Federal paper which was presented last week to the public ought to be supported by the four other conferees, and I hope that if they see their way to supporting that, this entire issue will be resolved before the enforcement conference wends its way through the 180-day procedure.

MR. HARPER: I concur with you and I have indicated in testimony I too support this. I support this on the basis of the last conclusion for ecological reasons, and I am sure you do. I think we are all people of good intent. For ecological reasons we support this. But for ecological reasons we should not be in this auditorium. The carbon monoxide level here right now may be 9 or 10; the permissible level is 13 p.p.m. So,"for ecological reasons" does not always govern, and I just make this point, that we live in a society that is a rather magalopolis from Milwaukee to Gary, and you must take into context a number of these factors if we are going to present to the board all of the testimony for the past week or 10 days.

I am glad to have your view. I agree with you wholeheartedly. For ecological reasons we should stop the heat -- for ecological reasons. Something I am far more concerned with is the chemical degradation, but ecological reasons do not always govern. It is unfortunate but that is the way of life. I didn't mean to --

MR. COMEY: There is probably one other thing that I shall point out in my written statement, and that is that based on all of the industry projections -- and these were brought out in the Federal paper -- the number two paper on the alternatives to thermal discharge -- the incremental cost of providing alternatives of cooling are very small.

Now, the Federal paper chose to use busbar costs. I think that is somewhat unfortunate because the public is not aware that the percent increase in busbar costs is considerably higher than in the incremental cost to the consumer. Normally busbar costs are about 21 percent of power charges. So that even assuming that the 9 percent for just cooling towers is the busbar incremental cost, this would represent less than a 2 percent additonal cost, and that on the average house-holder's bill it would be approximately 24 cents a month. Now, for a quarter, if we save Lake Michigan --

MR. HARPER: For a quarter, I am sure, for a dollar even. But if you put this off on the American public what are they going to do? What has the experience been in the proliferation of trash? We are no better.

But for a quarter -- and what is before the board here now is the determination to come up with either a standard or some means that is consistent with the needs of society and the people that vote, and these people have in mind that, "Oh, it is all right; let the American public pay another 25 cents." As you say, it may not set too well. It is unfortunate but it may not.

So we are in agreement there, and I am glad to have your views. I think the value of this whole conference is the diversity of opinion, and as long as we have this forum, it is essential. I think that this board -- if I might just proselytize a little -- Mr. Stein has shown remarkable objectivity to me -- not to me personally but to the diversity of views. How these gentlemen can sit through a week of this is beyond me. We are drawing to a conclusion now, fortunately, I would imagine.

I think that the point is well taken, but I would just like to emphasize the ecological reasons do not always govern, unfortunately. The pristine purity of Lake Michigan can never be restored to the time that Kinsey was first living on its shores.

MR. COMEY: Mr. Stein, may I be permitted to ask you one question?

MR. STEIN: Yes. Is the colloquy completed?

MR. HARPER: Yes, thank you.

MR. STEIN: Go ahead.

MR. COMEY: Supposing by December the other four conferees from the States are unable to agree upon any standard or criterion for thermal discharges to Lake Michigan? Is it possible for the Secretary of Interior upon recommendation of the Federal Water Quality Administration and other constituent bodies with the Department of Interior to lift the thermal criterion out of the enforcement conference and set Federal standards?

MR. STEIN: Well, whenever you ask a question of a person in the field you get the same kind of problem we had when we asked Professor McWhinnie something in her field.

One, I would suppose that -- because of my past experience with these conferees, and I have been working with these States for a long, long time --

we are going to come to an agreement, and I am very confident that we will.

The remarkable thing about our process of government or this process is, untidy as it may seem to many, we can resolve problems and come up with solutions even though we can't agree on philosophy, professional discipline, jargon, or what we think is the right way to express something.

However, we have two operations here: One, we have an enforcement conference; and, two, we have a standard-setting procedure. If we adopt the standard-setting procedure and we hold a Federal standard-setting conference, we have to give notice; we have to put that out. We will have to give the States six months to protest, and it is all built into the law. That is a rather time-consuming process.

MR. COMEY: You are talking about the 180-day procedure?

MR. STEIN: No, I am not talking -- as I say, the law is very complicated. If we would set a Federal standard, we hold the conference with the State, have all you people in again, make another record, and then we set a Federal standard. Then we publish that in the Federal Register -- first, we publish it before we go out, then we publish it again. Then we give the State six months to file a disagreement. Then if they do, we have a hearing. We are in a process like that with Iowa thermal standards, among other things, and that is taking quite a time.

I think if I sensed the feeling of the four States here as well as the Federal Government, we recognize the urgency of this problem and except as a last resort we will not permit ourselves to embark on a confrontation course between State Government and Federal Government which, by virtue of the time consideration, that is built into our statute, would place a resolution of this problem maybe a year off.

So I think we are all going to make a valiant effort to try to solve this by negotiation and discussion through this conference technique. Otherwise if we go the other way, it is at least going to be probably a year away before we can promulgate a Federal standard which should stand up, assuming that it is not modified in any way by the procedures that we have to go through in between.

MR. COMEY: So I take it that what you are saying is that this will be solved far sooner than the one year that would be necessary under the other procedure.

MR. STEIN: I am always optimistic. That is why

I am here, and that is why we go into the night. There isn't a place we won't go, nor a place or something we won't sit through, and patiently sit through, all of the evidence to try to cut that time down. If we wanted to sit on our bureaucratic doubts and just act the way we are authorized to act under the law, sure we can kick these procedures off, but it will take a long, long time before you would get a resolution. I think this is the best way and the fastest way. I would like to give it a chance.

MR. COMEY: Thank you.

MR. STEIN: May we have Harold B. Olin?

STATEMENT OF HAROLD B. OLIN, AIA,
MEMBER, BOARD OF DIRECTORS, LAKE
MICHIGAN REGION PLANNING COUNCIL,
CHICAGO, ILLINOIS

MR. OLIN: Mr. Chairman, members of the conference, ladies and gentlemen. I am appearing today on behalf of the Lake Michigan Region Planning Council, a 4-State planning organization sponsored by the American Institute of Architects Chapters of the States of Wisconsin, Illinois, Indiana, and Michigan. It is the objective of the organization to study resource problems from a regional point of view and recommend courses of action to governmental units and agencies.

The shores of Lake Michigan are ringed with a deadly necklace of some thirty power generating plants and a multitude of industrial plants spewing their waste effluent into the lake in ever-increasing amounts. Power-plants alone in 1968 were dumping almost 30 billion B.t.u.'s per hour of waste heat into the lake and the total for all industries and sewage treatment plants is over 40 billion B.t.u.'s per hour. By the year 2000 these figures are expected to increase almost 11-fold to 431 billion B.t.u.'s per hour.

Department of Interior and independent scientific studies document the devastating effect of these thermal discharges into the lake. Professor John Bardach of the University of Michigan, whom you heard earlier today also testified recently at several hearings on powerplants as follows:

"One electrical generating plant will have some adverse effect and several of them would exacerbate conditions in a more than additive manner, due to the prevailing hydrographic conditions set forth below.

"Some scientists believe that heated water remains on the surface and quickly loses heat to the atmosphere rather than to the water. However, present knowledge of water-air heat exchange and heat exchange between water masses in the regions of Lake Michigan to be affected is incomplete as there is not available information on all possible weather conditions such as patterns along the shore under which these exchanges would take place. Nevertheless, and especially if there are a dozen electrical generating plants along the shoreline and if the currents flow along this shore as they are indicated to do, long-term adverse effects of heating the shallow water are likely to occur and eutrophication is likely to be accelerated."

The First Annual Report of the Council on Environmental Quality states the problem in different words but with the same thrust. It also highlights the need to curtail thermal discharges, and I quote:

"Waste heat is one of the most serious emerging sources of water pollution. The electric power industry, which currently discharges over 80 percent of all the thermal heat into the Nation's waters, doubles its capacity every decade. The trend toward larger, nuclear plants, which creates 50 percent more thermal pollution in water per unit of power than fossil-fuel plants, could result in damage to aquatic systems, if it is not controlled.

With the tremendous thermal pollution potential of projected power production, it is fortunate that waste heat from electric generating plants can be adequately controlled. Waste heat and thermal pollution can be reduced by improving the efficiency of the plants; by making productive use of heat; and by the use of cooling towers, cooling ponds, or spray ponds."

Recognizing the need for additional power to serve the needs of a burgeoning economy, the Council's report recommends a National power policy based on broad based regional criteria of sound planning and environmental protection, which we heartily endorse. The Council's report says:

"For example, the need for a National energy policy is clear. As the demand for power increases rapidly, new power facilities have to be built. Powerplants will pollute the air with oxides of sulfur and nitrogen, the water with heat, and the landscape with mammoth towers and obtrusive power lines."

In his message to Congress transmitting the report of the Council, President Nixon emphasized:

"Unless we arrest the depredations that have been inflicted so carelessly on our natural systems -- which exist in an intricate set of balances -- we face the prospect of ecological disaster ....

"Natural systems are generally 'closed systems. Energy is transformed into vegetation, vegetation into animal life, and the latter returns to the air and soil to be recycled once again. Man, on the other hand, has developed 'open' systems -- ending all too often in an open sewer or an open dump.

"We can no longer afford the indiscriminate waste of our natural resources; neither should we accept as inevitable the mounting costs of waste removal. We must move increasingly toward closed systems that recycle what now are considered wastes back into useful and productive purposes. This poses a major challenge -- and a major opportunity -- for private industry."

The concept of closed systems endorsed by President nixon implies not just minimal discharges, but zero discharges into the lake. We support that stand and urge this conference to adopt a standard which would prohibit any thermal additions to the lake from any source.

Thank you.

I have a personal remark at this point. I am reminded of a statement made by a knowledgeable observer about a year ago, who pointed out that Lake Michigan, and especially the southern tip of it, is very much like a pus-filled appendix on the "bowel of civilization." I myself could use simpler terms to describe the same phenomena but in any case I want to point out that the patient is critically ill and surgery is needed immediately and I urge the conferees to take appropriate action -- very drastic action -- as soon as possible.

Thank you.

MR. STEIN: Thank you, Mr. Olin.

Are there any comments or questions?

If not, thank you very much, sir.

I have a statement I would like to put in the record as if read from A. J. Boehm, Executive Vice President of American Fishing Tackle Manufacturers Association.

(The letter above referred to follows on P. 2304.)

MR. STEIN: I think we called on these names before.

Mrs. Paul Kaefer.

(The following statement was submitted to be entered into the record as if read.)

CEntral 6-0565 • Area Code 312

AMERICAN FISHING TACKLE MANUFACTURERS ASSOCIATION

20 NORTH WACKER DRIVE • SUITE 2014

CHICAGO, ILLINOIS 60606

October 2, 1970

Mr. Murray Stein, Chairman
Lake Michigan Environment Conference
Sherman House
Chicago, Illinois

Statement of A. J. Boehm, Executive Vice President
American Fishing Tackle Manufacturers Association

Over the past four days much has been said pro and con about heated water from atomic power plants damaging Lake Michigan. We do not propose to reiterate these arguments; rather, we desire to have the records show that this Association supports the U.S. Government's proposed maximum of one degree heat rise in waste water discharged into the Lake from power generating sources.

Also, we would like to speak for the fisherman. Approximately 25 per cent of the 30-some million people who live in the four states surrounding Lake Michigan are fishermen. As fishermen, they violently oppose taking any risk that may jeopardize the fish, their sport, and also as a food supply.

The public is aroused and rightfully deeply concerned. The public is not of a mind or mood to accept any tinkering with their natural resources. The public is not objecting to any increased costs for the installation of cooling facilities at generating plants. The public has learned that it is much easier to prevent pollution before it starts than it is to stop it after it has begun. Lake Erie is certainly an example.

True conservationists who have studied the deterioration of our environment recognize the need for caution. Their watchword is "When in doubt, don't".

Signed____________________
A. J. Boehm
Executive Vice President

STATEMENT OF MRS. PAUL KAEFER, CITIZEN, NORTHBROOK, ILLINOIS

MRS. KAEFER: My name is Mrs. Paul Kaefer. I live at 3921 Oak Avenue, Northbrook, Illinois.

As a citizen I feel that the lake is my resource. When I use it I have a responsibility to not abuse it. All citizens, utilities, and industries have this responsibility. None of us must interfere with the nature of the lake. I ask you to set standards that would permit no heat to go into the lake.

In this age of space travel and other technical achievements, it is imperative that utilities and industries use such technological knowledge and devise methods so that no heat enter the lake.

I have a family to return to and my responsibilities do not permit me to stay past 11:30. I came at 9:30.

I want my testimony entered into the record.

MR. STEIN: Mrs. Robert Herlocker.

STATEMENT OF MRS. ROBERT D. HERLOCKER, CALUMET AREA BRANCH, AMERICAN ASSOCIATION OF UNIVERSITY WOMEN, MUNSTER, INDIANA

MRS. HERLOCKER: My name is Mrs. Robert D. Herlocker of Munster, Indiana. I am representing the Calumet Area Branch of the American Association of University Women.

The thermal standard proposed by the Department of the Interior gives us a ray of hope that man will have the intelligence to take action in time to avert disaster.

We do not ask, we do not request, we do not urge, we demand that the States adopt the recommended standard.

Most of our members live in Indiana in the Calumet region. In efforts to do something to clean up our environment, we encounter nothing but excuses and buck-passing between the State and local agencies:

"We don't have the manpower to do the job."

"We don't have the monitoring equipment."

"We don't have the money."

"These things take time."

"The laws aren't strong enough."

"Industry has a timetable."

We say to you now, and I address myself primarily to the Indiana representatives, all you need is the wisdom, the integrity, and the backbone to accept these recommendations. Remember, you are not servants of the Republican Party, of the Democratic Party, or of industry; you are servants of the people.

Ecclesiastes said: "To every thing there is a season, and a time to every purpose under heaven." This is the time to fulfill your purpose in the public interest.

MR. STEIN: Thank you, Mrs. Herlocker.

MR. MILLER: I only have one comment.

In all my time in public service if there is one thing I know it is that I am a servant. I always have been and always will be.

MRS. HERLOCKER: And you tell them in Indianapolis the public is after you and they have got to do something.

MR. STEIN: Thank you, Mrs. Herlocker.

May we have H. R. Thoke? Is H. R. Thoke here?

Mrs. Winston?

Mer. Berghoff?

Mr. James Sloss? (See P. 2308)

Mr. Michael R. Rouse? (See P. 2309)

Mrs. Maynard J. Seidmon? (See P. 2310)

Mrs. Lyman Barr? (See P. 2311)

Mr. Aaron Wolff? (See P. 2312)

JAMES SLOSS
605 SKOKIE LANE
GLENCOE, ILLINOIS 60022

September 26, 1970

RECEIVED
SEP 28 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

Mr. Clarence Klassen
Illinois Environmental
Protection Agency
535 West Jefferson Street
Springfield, Illinois 62706

Dear Mr Klassen:

I am writing to you regarding the forthcoming enforcement conference on pollution to be held between September 28 and October 2nd.

As a citizen of Illinois and a resident of Glencoe which is on the west shore of Lake Michigan, I urge your support of the most stringent thermal pollution standards which may be considered at this conference. In view of the many nuclear power plants scheduled for operation on Lake Michigan's shores in the near future, the failure of this conference to adopt such stringent standards could have a cumulative effect on the temperature of Lake Michigan which could cause tremendous environmental damage to the Lake and its environs.

Your consideration of this request will be greatly appreciated.

Sincerely yours,

James Sloss

2309

1024 Palmer Place
Waukegan, Illinois 60085
September 27, 1970

Clarence Klassen
Ill. Environmental Protection Agency
Springfield, Illinois

RECEIVED
SEP 29 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

Dear Sir;

This is a letter from an ecology-minded Lake Michigan citizen concerning the installation of nuclear reactors by Commonwealth Edison around the lake and with the thermal pollution threat. I wish to express my opinion that these nuclear plants must not be deployed. Lake Michigan is already in enough trouble without this new threat of temperature rise and radioactive accident. If these nuclear plants cannot be stopped (alas, they have already started!), then at the very least the one-degree above lake water temperature rise recommended must be upheld and rigidly enforced. Already, at various times, the beaches here in Waukegan have been closed, as in other Lake Michigan communities. But, the beaches aren't the most important thing. It is life, itself that is threatened, the life of Lake Michigan, the life of its fish and other animals, its plants, and eventually the chain includes the life of man. He too is threatened. It's time we started realizing the dangers of pollution caused by a monopolistic politically powerful electric company are more real than they would have us believe.

Sincerely,
Michael R. [illegible]

MRS. MAYNARD J. SEIDMON
1064 Skokie Ridge Drive, Glencoe, Illinois 60022

Sept 25 1970.

RECEIVED

SEP 28 1970

ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

Dear Sir: -

At the Conference scheduled to start on Sept. 28 - I urge you to adopt the strictest standards possible concerning thermal pollution of Lake Michigan

Sincerely,
Mrs M Seidmon

(The following letter, dated September 25, 1970, from Mrs. Lyman Barr, 1005 Wade Street, Highland Park, Illinois 60035, was received by the Environmental Protection Agency, State of Illinois, on September 28, 1970, and was submitted for inclusion in the record.)

Mr. Clarence Klassen
Illinois Environmental Protection Agency
535 W. Jefferson Street
Springfield, Illinois 62708

Dear Sir:

I feel it is of the utmost importance that the 4-State Enforcement Conference on Lake Michigan Pollution should adopt the strictest possible standard in respect to thermal pollution -- that announced by the Department of the Interior. I urge you to do everything you possibly can to bring this about.

Yours truly,

(Signed)

Lucy M. Barr

2312

RECEIVED

SEP 28 1970

ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

AARON S. WOLFF
11 SOUTH LA SALLE STREET
CHICAGO 60603

AREA CODE 312
FRANKLIN 2-5461

September 24, 1970

Mr. Clarence Klassen
Illinois Environmental Protection Agency
535 West Jefferson Street
Springfield, Illinois 62706

Dear Mr. Klassen:

Since you are head of the Illinois Environmental Protection Agency, I strongly urge that you do all in your power to avoid thermal pollution of Lake Michigan. At the forthcoming Federal-State Enforcement Conference on pollution of Lake Michigan, I certainly hope that you will push for adoption of the strictest standard under consideration. This would be that of the Department of the Interior which would sanction only the minimum possible waste heat to be discharged into Lake Michigan or a 1° F. rise over ambient at the point of discharge, whichever is less.

Very truly yours,

Aaron S. Wolff

ASW:sf

Closing Remarks - Mr. Stein

MR. STEIN: I guess that is all the people's names I have.

Now, does anyone who hasn't been called feel that they want to say something now, because we are going to close?

If not, I would like to thank a lot of you for bearing with us. I know some of you have stayed with us all week, and I think we have amassed quite a record.

There is one thing I would like to say for this process, and I have always been proud of this in a way.

I think we have a document here in the transcript of this conference which is going to be invaluable. I find when we finish these things that the researchers, the planners, the analysts through the years in going for hard information that they can use constantly turn to these transcripts.

Now, again, the pride I have is this: If Government -- I don't know, maybe industry is a little bit wealthier -- but if the Government were to amass this kind of thing through the other processes that they have in grants or contracts, I will bet that this would cost about a half a million dollars -- what we have here.

We got this and a good portion of this has been a contribution to the public good, and we couldn't have gotten it without the volunteer action of the citizens, the municipalities, the industries, the State Government, concerned. And certainly all of these groups have brought in scientists, consultants, other interests that one would have been beyond the capacity of the Government alone -- any government -- to assemble, and certainly beyond our budgetary capacity.

That is one of the great things about these democratic institutions—that we have drawn on the kind of talent and the considered statements that we could draw on for the past week, and we were able, without I think getting really out of hand from the standpoint of a disciplinary way, to have a cross-examining of ideas and questioning as far as we could.

I think you all must appreciate that this is a very difficult thing to do, because we have people from disparate backgrounds, disciplines, and ways of doing business coming here. These conferences are a lot easier to handle when we just have the conferees asking questions, or you have a much easier job if you just have lawyers arguing back and forth or questioning back and forth or presenting evidence under their rules -- at least what we think are rules -- or if you have biologists or you have engineers or architects who know how to operate.

I think the wonderful thing is that we could hold a meeting like this and get all of the people with different backgrounds and different disciplines to focus on the problem, and I think that the people who have been here -- I would say about 99.44 percent of the material put in was germane -- germane to the problem, and that also is wonderful. You may not have agreed with it, but it was what someone thought we should know about the problem.

Now, I have this to suggest to the conferees, and I don't want anyone to think this is a suggestion that I haven't floated around for the past day to see what its acceptance would be.

In view of the complexity of the matter, I would ask that the conferees go back to digest this material, caucus and advise with their technical staffs, as I will. I know next week a lot of us are committed to be in Boston where the Water Pollution Control Federation is holding its meeting and we are going to need the week anyway.

I would suggest possibly the week after that, I would ask the conferees -- and I would like to keep this meeting as small as possible, if we can, for participants, because we are going to try to come out with an agreement and a program -- that the conferees meet with their views and their proposals, and we sit down and try to come up with conclusions and recommendations which we can present.

Closing Remarks - Mr. Stein

I would urge the conferees to get together with their neighboring States, Federal representatives, and others, caucus as much as you like, and I think the more caucusing you do before you get there, the better off we are going to be, whether you do it in Boston or over long distance telephone, or any other place. I am optimistic that we will be able to arrive at a conclusion when we meet, say, the week after next. But if we can't, at least see how many areas of agreement we can sign off on, and whether there are any areas that we have to put off because we can't come to an agreement.

There is just one more thing. This problem is on us. I don't think it is going to go away. I don't think it is going to wait, and I don't think -- while I haven't made a poll, I don't think the public is going to wait very long for an answer.

I want to again thank you people. Right now the ball is on this side of the net. The Federal and State officials have got it right in their court, and I think we will have to move from there.

Do any of the conferees --

MR. CURRIE: Yes, Mr. Chairman.

I would like to introduce into the record a letter which I sent to Secretary Hickel on September 17, making certain suggestions for the format of future proceedings in the conference, among other things suggesting that the conference publish an agenda in advance so that we know what we are to discuss at our meetings; in addition that conferees and expert witnesses be asked to supply reports in advance so that we have time to understand them: and among other things reconvene the conference every three months.

And I would like to make that suggestion now, Mr. Chairman, that we meet again in three months after we have solved, if we have solved, this thermal pollution question, in order to consider other pollution problems that are equally pressing.

MR. STEIN: We will consider all those suggestions and, I think, without objection, that letter will appear in the record.

(The letter referred to above follows on Pages 2318-2320.)

STATE OF ILLINOIS
POLLUTION CONTROL BOARD
189 WEST MADISON STREET
CHICAGO, ILLINOIS 60602

TEL. NO.
312-793-3620

September 17, 1970

Secretary Walter J. Hickel
U. S. Department of the Interior
Washington, D. C. 20242

Dear Mr. Secretary:

On September 28 the Lake Michigan Enforcement Conference will reconvene in Chicago for a five day "workshop" session. The Illinois Pollution Control Board is the agency charged with statutory responsibility for the adoption of water quality and effluent standards. In view of the Conference's concern with state regulation as well as with the collection of information, Mr. Clarence Klassen, Director of the Illinois Environmental Protection Agency, has written to the Conference Chairman, Mr. Murray Stein, requesting that the Illinois Pollution Control Board be designated an official participant, in the Conference.

In anticipation of our designation as a participant in the Conference I am listing below some proposals designed to make the Conference a better vehicle to accomplish its purpose---to save Lake Michigan. Copies of this letter are being sent to other parties in order that they may have sufficient time to comment or endorse these proposals if they wish.

The Council on Environmental Quality in its first Annual Environmental Quality Report to President Nixon has criticized water pollution control enforcement conferences and recommends new legislation. The proposals listed below will make the coming Enforcement Conference and future sessions more democratic and more responsive to public interest as well as better directed toward Lake Michigan's specific problems.

The following proposals which can be put into effect without new legislation are offered:

1. Publish an agenda for the Conference immediately. The notice of the Conference is not clear as to whether the Conference will deal only with the proposed thermal pollution standard or with all pollution matters affecting Lake Michigan.
2. Require that all reports by parties to the Conference and by expert witnesses be submitted in writing in advance to the Great Lakes Regional Office of the Federal Water Quality Administration, there to be made available for public inspection.

In past Conference sessions, voluminous and detailed reports have been presented with no time for the conferees or the public to thoroughly review them. Comments and questions would be much more meaningful if advance copies are required.

3. Permit questioning of witnesses and agency representatives by the public where new information can be gained. This procedure is followed by our Board in its public hearings, and it would serve to make the Conference more democratic and more informative.

4. Reconvene the Conference every three months until December 31, 1972. Every State has already submitted seven checkpoint dates for all construction required by listed polluters. Frequent and public checks on adherence to these dates will be necessary in order to avoid the excessive time slippage encountered in the Lake Erie Conference.

5. Publish within three months a comprehensive waste inventory for Lake Michigan to be prepared by FWQA with the assistance of the States. A Chicago Daily News story of August 3, 1970 based upon FWQA data argues that 51.3 tons of oil and 223.2 tons of suspended solids are now being discharged into Lake Michigan every day by just three Indiana industries. No one knows the total amount of oil, solids, phenols, chlorides, and other significant pollutants going into Lake Michigan every day. Yet this information is easily obtainable through the States and merely needs to be compiled. It would serve to identify the major problems and major sources.

6. Identify, with FWQA assistance, all significant polluters affecting Lake Michigan and not presently listed by the State of location as coming under the Conference jurisdiction. Four industries in the Manistee, Michigan area are said to discharge almost 1,500 tons of salt to Lake Michigan daily and yet are not under the Conference purview. We evidently cannot let each State be the judge of what constitutes "significant" pollution of Lake Michigan. It is most important that pollution discharges to tributaries of the Lake be included and controlled.

7. Accelerate the deadline for phosphorus removal at municipal and industrial sewage treatment plants from December 31, 1972 to December 31, 1971. Phosphorus removal technology is well known and can be installed at any stage of any existing sewage treatment plant, and reinstalled in a plant expansion. If phosphorus removal is indeed the key to Lake Michigan's survival then we must keep as much phosphorus out as soon as we can.

Very truly yours,

David P. Currie

David P. Currie
Chairman

DPC: jb

CC: Board Members
Mr. Clarence Klassen
Ass't. Secty. Carl Klein
Comm. David D. Dominick
Asst. Comm. Murray Stein
Mr. Francis T. Mayo
Mr. Ralph Purdy
Mr. Thomas Frangos
Mr. Blucher Poole

MR. SHELDRICK: Michael Sheldrick, McGraw-Hill.

Can you tell us where the meeting will be, and I assume -- am I correct in assuming that it will be an executive session? Where, what time, pertinent details?

MR. STEIN: We haven't decided on a place yet and I generally don't decide on a place until I confer with the conferees and the people back in Washington. But this will be made known to you, and the kind of meeting we will have will be determined by the conferees. It will be an executive session.

MR. SHELDRICK: Can you give us the date perhaps?

MR. STEIN: No, I can't.

MR. SHELDRICK: Other than a week.

MR. STEIN: No, again, we have all been away from the office for a week.

Let me just go off the record here.

(Discussion off the record.)

MR. STEIN: Back on the record.

The putting together of a 4-State conference with Federal officials, given the pulse and the mandatory appearances of these people, is something that we have to work out. We have always worked them out in the past, but I don't think that until these people, who have been away from their offices, could get back and touch base that we can set that up now.

MR. SHELDRICK: Did I hear you right when I thought you said that you were hoping to meet the week after next?

MR. STEIN: That is right. That is what I was hoping for.

MR. FETTEROLF: Mr. Stein, did you make a decision that it would be an executive session?

MR. STEIN: Well, yes, in the terms -- you know what we mean by executive session? Only the conferees will speak. I can't say yet whether it would be open or closed.

MR. FRANGOS: Mr. Stein, just in response to Mr. Currie's suggestions on meeting, I believe that you also have a request or a suggestion from the State of Michigan concerning the frequency of meetings and, as you point out, this does take a considerable amount of time, and it drains not only our own capability but our staff's capability.

Perhaps rather than increasing the frequency to every three months we might be able to devise a better communication system so that these conferees know what is going on in each of these States, and then indeed if there are some questions, we can meet, but my own feeling is that three months is awfully soon.

MR. STEIN: Sir, I would prefer at this stage -- I know Mr. Currie has made some suggestions. I said if it is agreeable. I think we should hold those off because I know a discussion on these -- I know the conferees and other people have had experience here, and they have many, many differing views on the mechanism of holding the conference, and they run the entire gamut. I know representatives of other States have quite different views, and I think another place is the place to discuss procedure which is only of interest to another bureaucrat rather than here at this time.

So I would like to set that off for a little while. We will discuss it when we hippopotami get together by ourselves.

Are there any other comments or questions? Again, I would like to thank you for coming and the workshop stands adjourned.

(The conference adjourned at 5:58 p.m.)

- - -

(The following documents and communications were received following the conclusion of the conference for incorporation in the record.)

RECEIVED
SEP 28 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

To: C. W. Klassen, Technical Secretary, Illinois Sanitary Water Board, 616 State Office Building, Springfield, Ill. 62706.

We, the undersigned, believe that it is both technically and economically feasible for industry to meet the proposed Federal Water Quality Administration's temperature standards of a one degree F maximum temperature increase of all waters returned to Lake Michigan. Thus, we urge the adoption of these standards in the state of Illinois.

Respectfully,

Concerned Citizens

(49)

Mrs. Warren Huck
Mrs. Lawrence McCall
Mrs. Donald Lundin
Mrs. Gerald Scheuer
[illegible] Haaland
Margot Veirup
Carol Barritt
Mrs. Kay O'Kernan
Mrs. Michael Davis
Vivian Sarbinski
Suzanne Long
Mrs. David Molyeo
Mrs. John Donansky
Sallie DiLisso
Jackie Harries
Rosemary Sabato
Mrs. Jack Doah
Mrs. Robert Hardt
Mrs. James Ford
Mrs. Richard Mating
Mrs. John M. Summers
Mrs. Thomas Virks
Mrs. A. Romanovich Jr
Mrs. [illegible]
Mrs. James E. Derrison
Mrs. Joseph Stapf
Mrs. George O'Day
Mrs. Donald Kraste
Mrs. A. David Koch

Mrs. Wayne Slager
Mrs. George Zemaitis
Mrs. Thomas Sezniak
Mrs. James G. Terry
Mrs. [illegible]
Mrs. Patricia O'Connor
Mrs. James Ing
Mrs. L. Kuchta
Mrs. Monty Dunphey
Mrs. [illegible]
Mrs. John Kiecmajick
Mrs. William Zibley
Mrs. Scott Muller
Mrs. Marilyn Hinde
Mrs. Jerry Mikulich
Mrs. Jonathan Kolitzke
Joan B. Boone
Irene C. Zalucky
Carole Kolitzke
Mr. + Mrs. A. K. Cutler

CTB

379 Jackson Ave.
Glencoe, Ill. 60022
Sept. 24, 1970

Mr. C.W. Klassen
Director
Environmental Protection Agency
c/o Illinois Sanitary Water Board
1717 W. Taylor
Chicago, Illinois

Dear Mr. Klassen:

Thank you very much for keeping me informed on the September 28-October 2 Workshop of the Lake Michigan Conference.

The Glencoe League of Women Voters will not be testifying at these workshop sessions, but I understand that the Lake Michigan Interleague Group plans to speak on thermal pollution standards. I am very interested in the subject matter to be discussed, as I have personally studied thermal pollution problems and standard-setting questions. However, our League has not yet completed a formal study and consensus position and is therefore unable to testify.

I plan to attend at least two of the sessions; and I hope to be able to thank you personally for so considerately offering our League time on the agenda and keeping us up to date on the content of the Workshop sessions.

Very truly yours,

Mrs. Richard Schnadig

Mrs. Richard Schnadig
Action Chairman
Glencoe LWV

Enf. 9/28

152 Orchard Lane
Benton Harbor, Michigan 49022
September 21, 1970

Mr. Murray Stein, Chairman
Federal-State Enforcement Conference on Pollution of Lake Michigan
Federal Water Quality Administration
Room 410
33 East Congress Parkway
Chicago, Illinois 60605

Dear Mr. Stein:

Your announcement of August 31 of a workshop for presentation of viewpoints on pollution of Lake Michigan has been received.

Speaking as a private citizen whose water supply and many recreational pleasures come from Lake Michigan, I am opposed to the siting of any nuclear power plants on the shores of Lake Michigan. In terms of the risk of radioactivity and thermal pollution presented by these plants, the benefits of siting on Lake Michigan are inadequate, particularly since alternate sitings are technologically feasible and economically within reach. A more complete statement asking a ban on placement of nuclear reactors on Lake Michigan is presented in my letter to Governor William Milliken of my home state of Michigan, a copy of which is attached.

If it be within the scope of the format of the workshop, I would ask that this letter, as well as the attached letter to Governor Milliken, be read into the record on September 28 or 29, days listed as dealing with problems of Public Utilities.

Thank you for your consideration of this request.

Very truly yours,

W. D. Mohr

W. D. MOHR, P.E.

cc: Mr. Francis T. Mayo
FWQA, Chicago

Encl.

152 Orchard Lane
Benton Harbor, Michigan 49022
July 1, 1970

Governor William Milliken
Office of the Governor
State of Michigan
Lansing, Michigan 48903

Dear Governor Milliken:

This letter is to request that you and your administration actively seek a ban on nuclear reactors on the shores of Lake Michigan.

Background

The hearings in progress at Kalamazoo by the AEC Licensing Board with regard to the provisional operating license for the Palisades Plant of Consumers Power Company have produced indication that the AEC will seek or consent to oversee water quality effects of nuclear reactors, including thermal effects. The passage of laws by the Congress of the United States in 1969 and 1970, namely, the Federal Water Quality Act, and the National Environmental Protection Act, require both a broader interpretation of the Atomic Energy Act than the AEC has previously been willing to assume and active steps by the AEC to enhance the environment.

With the AEC about to enter jurisdiction formerly held by the Department of Interior and the several states, a new opportunity arises to control our environment. Concise leadership on the part of the State of Michigan, due primarily to our central location and important dependence on the Great Lakes, can be greatly rewarding for decades and centuries to come.

Specific Technical

Elimination of thermal effects by use of cooling towers, and prohibition of discharging radioactive liquid wastew to the lake as an operational practice, may well come from AEC activities. These moves are inadequate to protect Lake Michigan.

The maximum accident involving a nuclear reactor on the shore of Lake Michigan is to picture it chopped into small bits and dumped into the lake. This accident, however remote the possibility, would be unpleasant to Michigan. The 100-year holdup time of Lake Michigan would mean elimination of the resort and farming industries for decades. The source of drinking water for millions of people would be contaminated. The radioactivity passing through the Great Lakes and the St. Lawrence River would imperil millions more.

Economic

If the alternative were EITHER nuclear reactors OR no electricity, this letter would not be written. But in truth, the economic tradeoff involved in this matter has not been discussed, let alone decided in a dispassionate manner. And an economic tradeoff does exist. Nuclear reactors sited on Lake Michigan get cheap cooling water. Non-evaporative cooling towers, which would permit the plants to be sited in inland regions of low population density, add to the cost of plant investment. The question involves "How much?" and "Is it worth it?" A Maryland report on the Calvert Cliffs plant presents estimates of $28 million and $40 million for additional plant investment on a base plant size of $250 million. Estimating plant investment increase at 20% for non-evaporative cooling towers, and recognizing that the cost of producing electricity is a minor fraction of the "delivered" charge to the consumer, the added cost to the public would be less than 10% on the electric bill.

Evaluation

The evaluation requires the tradeoff of less-than-10% on the electric bill, known and regular, against the cost (colossal) of an event of unpredictable rarity (gross disintegration of a nuclear reactor). Considering the unique properties of Lake Michigan, true wisdom requires us to choose the course of accepting the nominal increase in exchange for preventing the rare possibility of catastrophe to the lake.

Practical Present

It is my request that you, as Governor of this state, take the leadership in the administration of state government by undertaking steps that will produce a ban on nuclear reactors on Lake Michigan. In consort with the AEC, the Department of Interior, and the governmental units of the other states fronting on Lake Michigan, this ban should be worked out with dispatch.

Very truly yours,

W. D. MOHR, P.E.

cc: General Distribution

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LAKE MICHIGAN ENFORCEMENT DLY 75 SN

CONFERENCE WORKSHOP ATTN MURRAY STEIN CHAIRMAN CARE SHERMAN HOUSE BAL TAMURIN RM 6TH FLR CHGO

AS A CONCERNED CITIZEN I URGE THE LAKE MICHIGAN CONFERENCE TO PROPOSE STANDARDS FOR THERMAL POLLUTION FOR LAKE MICHIGAN WHICH WILL NOT ALLOW THE QUALITY OF THE LAKE TO BE DECREASED IN THE SLIGHTEST DEGREE WITH THE EXAMPLE OF LAKE ERIE BEFORE US, WE MUST DO EVERYTHING WITHIN OUR POWER TO HALT AND REVERSE THE PROGRESS OF ENTROPHICATION OF LAKE MICHIGAN WE CANNOT AND WE MUST NOT TAKE CHANCES WITH OUR ENVIRONMENT ANY LONGER. LAKE MICHIGAN ISTA MAJOR RESOURCE FOR THE CITIZENS OF ILLINOIS AND OF THE NATION AND IT MUST BE PROTECTED

ADLAI E STEVENSON III

(307).

SF1201(R2-65)

October 8, 1970
11653 N. Wauwatosa Road 76 W.
Mequon, Wisconsin 53092

Mr. Francis W. Mayo,
Regional Administrator
Federal Water Quality Administration
33 W. Congress Street
Chicago, Illinois

Dear Sir:

My understanding, according to Mrs. Rheta Pierre, Secy. to Murray Stein, is that the written statements may be submitted for the Official Record of The Lake Michigan Enforcement Conference, Chicago for one week, following the close of oral presentations, Friday, October 2, 1970.

I would please request incorpoation of the enclosed letter into the official record, which indicates very recent "happenings" as the licensing of Point Beach, on Oct. 6th by AEC.

I would appreciate receiving a copy of the Lake Superior 1970 Enforcement Conference proceedings. I received copy of the Oct 1, 1969 proceedings today. and have already underscored the text through to Page 249.

CONSERVATIONALLY YOURS,

Grace Marie Knapp

LAKE MICHIGAN ENFORCEMENT CONFERENCE

It was my understanding that the thermal decree of 1 degree was enforced as such, though still in question and "still negotiable". It would have been comforting if it would not be the burden of the public to "defend" same, for 1 day, while power companies (by coincidence had their convention in Chicago simultaneously with their presentation days...Monday, Tues. Wed. 9-28-29-30) One can only guess the impact of expense paid testimony, by experts, versus presentations by citizens, laboriously and expensively establishing their own private environmental data libraries, subscribing on their own to outrageously expensive scientific periodicals and publications, without benefit of a federal agency repository for scientific research (research grants paid for through taxes and oft with FWQA funds.)

Since the newly created Environmental Protection Agency which became effective Oct. 2nd, Friday, but had a 60 day "grace" period, requested by the President, just in time to LICENSE POINT BEACH NEUCLEAR PLANT at Two Harbors on October 6th, 1970, Tuesday. So things weren't in Limbo! In effect, while FWQA incites and excites the engineering debate of the century, negotiating under corporate & political pressure, buying just enough time for a fox to his piece de resistance. (EPA includes FWQA, NAPCA, Bur. Solid Waste Mgmt, Bur.Water Hygiene & Environmental Radiation protection functions of AEC & pesticide registration of USDA.) All this, under direct control of the President (to whom all things are negotiable). (As if corporate structure hasn't always known political pressurepoints.)

Please refer to FWPCA bulletin of Sept. 1969 "HEAT CAN HURT - Better Water for America" indicating research being carried on at the Natl. Water Quality Laboratory at Duluth (I've toured same & don't remember the project) & reference to research at the Natl. Marine Water Quality Lab., W. Kinsington, R. I. WHY wasn't the benefit of this research introduced to advocate the Public's and Taxpayer's re-vested interest?

I refer for your research people (if you are not already aware of the article,) "Thermal Pollution & Adquatic Life by John R. Clark, in Scientific American, March 1969. I have dozens of papers from scientific journals, and $1\frac{1}{2}$ inches of articles clipped out of newspapers, touting public interest and concern. It is suffice to say, that inasmuch as you are charged with the responsibility to protect our public waterways, (fron whatever deleterious matters, and affects from whatever source) regardless of political and corporate pressure, from WHATEVER source, for whatsoever reason, do so, forthrightly and with integrity.

Given the foresight to predict, even with 100% total inaccuracy, in FAVOR OF the total environment and the citizens of the Great Lakes Basin Region, it would be a far wiser error, than with hindsight, in retrospect 50 years hence, to discover that our beautifully precious Lake Michigan (& Superior) have attained the dubious distinction of becoming another errie "Erie" becaused you "chanced it".

Stick by your 1°F thermal decision, let technology & cryogenics manipulate the means, and dedicate yourselves immediately to pesticides, phosphates, chemicals etc. Since the Bureau of the Budget regulates your questionairre activities from Industry, do not, in the name of justice, thwart pollution evidence, from whatever state or source, by keeping it from the printed record.

When will the DETERGENT industry, PETROLEUM & CHEMICAL cartels be confronted, as was Reserve Mining in the L. Superior Enforcement Conference?

Please keep in mind a potential axium...THE QUALITY OF OUR ENVIRONMENT IS NOT NEGOTIABLE.

(Conservationally Yours,)

GRACE MAR[illegible]PP
11653 [illegible] Wauwatosa Road 76[illegible]
Mequoh, Wiscon[illegible] 53092

Member of Natl. & Milwaukee Audubon Society (Bdard) & Legislative Committee for
Audubon Society Natl. Convention - 1971 - Milwaukee
Wisconsin Resource Conservation Council
Milwaukee River Restoration Council
Citizens Natural Resource Association
League of Women Voters
Save Lake Superior Association
Wisc. Academy of Science, Arts & Letters
National Wildlife Federation - 1970 Conservation Summit, Estes Park, Colo.

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MURRAY STEIN, CHAIRMAN LAKE MICHIGAN ENCORCEMENT CONF, DLY

75

SHERMAN HOUSE HOTEL 112 WEST RANDOLPH ST CHGO

THOUGH THE EXACT EXTENT OF POTENTIAL DAMAGE TO LAKE MICHIGAN BY THE INTRODUCTION OF MASSIVE QUANTITIES OF WASTE HEAT IS AS YET UNDETERMINED, THERE IS ENOUGH EVIDENCE TO MAKE IT CLEARK THAT THE CONSEQUENCES COULD BE CATASTROPHIC. FEDERAL REPORTS WHICH HAVE BEEN PRESENTED TO THIS CONFERENCE CITE THE DANGERS AND DEMONSTRATE THAT THERE ARE AT LEAST SIX REASONABLE AND FEASIBLE ALTERNATIVES TO DISCHARGING HEAT WASTES TO THE LAKE FROM POWER PLANTS. THE CONFEREES SHOULD ACT IMMEDIATELY TO ESTABLISH A TOUGH STANDARD ON THESE PLANTS, PROHIBITING THE DISCHARGE OF WASTE HEAT TO THE LAKE. THERE IS NO VALID REASON TO GAMBLE WITH THE FUTURE OF THIS PRICELESS RESOURCE WHEN IN

SF1201(R2-65)

PACT SUCH A RISK CAN BE AVOIDED WITH AVAILABELE TECHNOLOGY.

GAYLORD NELSON US SENATOR

(353).

September 28, 1970

Mr. Murry Stein, Conference Chairman
Thermal Pollution Workshop
Sherman House
100 West Randolph Street
Chicago, Illinois

Dear Mr. Stein:

Enclosed you will find a copy of the Michigan State Chamber of Commerce's Policy on Thermal Effects which was adopted by our Board of Directors on January 21, 1970.

Please enter this into the proceedings of the Department of Interior's Thermal Pollution Workshop currently underway in Chicago.

Sincerely,

George P. Graff,
Manager, Natural Resources

GPG/sk

Enclosure

cc: Francis T. Mayo
Ralph Purdy

MICHIGAN STATE CHAMBER POLICY ON THERMAL EFFECTS

The Michigan State Chamber of Commerce has long recognized the need to protect and enhance the quality of the environment in the State of Michigan. Cooperative efforts of both the public and private sectors are necessary to effectively promote this objective.

The Waters of the State of Michigan are an important segment of the environment and should be so respected. The potential effects of thermal discharges to these waters are not fully understood. However, it is known that in some instances these effects are detrimental to legitimate uses, while in other instances they are beneficial.

Recognizing that there are many needs and objectives in society, and that they cannot all be satisfied in their entirety, the State Chamber strongly recommends that the Michigan Water Management Program, with particular reference to thermal effects, be guided by the following principles:

1. That no single set of regulations is adaptable to all situations.

2. That the management program provide for beneficial water uses, with joint consideration of alternative costs to society and the objective of preserving environmental quality.

3. That water quality standards regarding thermal effects adopted by the State are consistent with the water use management program which recognizes the needs of our society and further that Michigan industry will comply with all state standards.

4. That any use which has potential of causing significant environmental effects be carefully monitored to determine the extent of any effects and the possible need for corrective action.

5. That prompt corrective action be taken whenever effects detrimental to legitimate uses are detected.

6. That thermal effects research be promoted in an effort to obtain sound data from which intelligent judgments can be based regarding thermal discharges.

The State Chamber commends the responsible State agency's accomplishments in the area of water quality control and pledges its continuing support and cooperation in efforts to provide an improved environment and high quality water in the State of Michigan.

F. SCAMMON BARRY
611 HUNTER RD.
GLENVIEW, ILLINOIS

Sept. 27,1970

Francis T. Mayo, Dir.
Regional Office, US Dept. of the Interior
Federal Water Quality Adm.
33 East Congress Pkwy Rm 410
Chicago, Ill. 60605

Dear Mr. Mayo:

I urge you to use all of your influence to get the 4-state Enforcement Conference on Pollution of Lake Michigan to adopt the strictest standard under consideration for thermal pollution. I believe that is the standard announced by the Dept. of the Interior.

This opinion states: "the mimimum possible waste heat shall be added to the waters of Lake Michigan. In no event will heat discharges be permitted to exceed a 1 degree rise over ambient at the point of discharge. This will preclude the need for mixing zones."

Yours truly,

F. Scammon Barry

September 28, 1970

Mr. Francis P. Mayo
Director, Great Lakes Regional Office
U. S. Dept. of Interior
Federal Water Quality Administration
33 E. Congress Expressway Room 410
Chicago, Illinois 60605

Dear Mr. Mayo:

I would like to voice my support for the establishment of strict standards controlling heat discharges into Lake Michigan and other waterways. There should be no difference in waterway and discharged water temperature that cannot be attributed to error in measurement.

It is time to take decisive action. Caution must be exercised now. It will be easier to ease restrictions in light of future findings than it will be to view useless bodies of water and wish there had been more foresight.

Yours truly,

E. M. Davey

September 26, 1970

Mr. Francis T. Mayo
U.S. Dept. of the Interior
Federal Water Quality Administration
33 E. Congress
Chicago, Ill. 60605

Dear Sir:

I am a member of and dissentient from the Committee on Lake Michigan Pollution. I have several comments on heating of the lake.

1. The bad effects of heating are not now proved. The hot water discharge from Waukegan steam plant of Commonwealth Edison has made good fishing for years. Likewise, the waters of the warm Carribean have good fishing.

2. The real problem faced is what to do about Lake Michigan when we think the heat discharge may have deleterious effects. These effects must be balanced with the effects of a shortage of electricity.

3. Ecology is important; so is justice. It is not just to have several government bodies approve the Zion nuclear plant, and then demand that Edison spend more millions than planned. This is particularly the case when the alternative heat exchange to the atmosphere has unknown effects, also.

4. The proposed standard of the Dept. of Interior that will prohibit heat discharges of more than 1° above ambient is absurd. It would prohibit swimming. It would prohibit small motors. It would prohibit dumping a thimblefull of boiling water. It would permit the discharge from Zion nuclear station as long as Edison spent money on more pumps to push thru a larger volume of water. If there is any kind of limit, it should be stated in btu's per minute, or other units of power. And it should not apply in the Winter.

Yours very truly,

Robert Dover

Robert Dover
917 Chestnut Ave.
Wilmette, Ill. 60091

copy:
James Griffith
Comm. on L. Mich. Pollution

PETIT, SAFEBLADE, LITTLEJOHN & GLASS
ATTORNEYS AT LAW
HARRIS BANK BUILDING
111 WEST MONROE STREET
CHICAGO 60603

ADELOR J. PETIT, JR.
JOHN A. SAFEBLADE
WILLIAM L. LITTLEJOHN
BRADLEY M. GLASS
EDWARD ATLAS
DAVID C. FALLS
JAMES P. McCARTHY, JR.

ROY E. OLIN
OF COUNSEL

ADELOR J. PETIT (1892-1951)

AREA CODE 312
726-1025
263-3060

September 30, 1970

Clarence Klassen
Ill. Environmental Protection Agency
535 West Jefferson Street
Springfield, Illinois 62706

Murray Stein, Conference Chairman
Federal Water Pollution Control
Administration
Department of the Interior
Washington, D. C. 20242

Francis T. Mayo, Director, Great Lakes
Regional Office
U. S. Department of the Interior
Federal Water Quality Administration
33 East Congress Parkway, Room 410
Chicago, Illinois 60605

Gentlemen:

I am taking the occasion of this week's Enforcement Conference on pollution of Lake Michigan to register with you my deep concern for the need to establish and enforce strict thermal pollution standards.

Commonwealth Edison has been quoted as urging retention of Illinois' present standards (permitting a water temperature increase of up to 5^{o}) on the ground no evidence exists proving conclusively that heated water discharges will adversely affect the Lake.

I disagree with this approach. In this matter, so directly affecting the public interest, the evidence must prove conclusively that such discharges will not adversely affect the Lake. Our Lake belongs to the people. It cannot be replaced.

Page Two
Clarence Klassen
Murray Stein
Francis T. Mayo
September 30, 1970

No harm must come to this priceless resource. Whatever legitimate doubts exist regarding the safety of discharging waste heat into Lake Michigan must be resolved in favor of the overriding public interest.

Accordingly, I wish to pledge my support for the previously stated position of the U. S. Department of the Interior that: "The minimum possible waste heat shall be added to the waters in Lake Michigan. In no event will heat discharges be permitted to exceed 1° F. rise over ambient at the point of discharge."

Yours very truly,

Bradley M. Glass

Bradley M. Glass, Republican Candidate
for Representative in the General
Assembly, First District

BMG/ak

2341

9-25-70

MRS. LYMAN BARR
1005 WADE STREET
HIGHLAND PARK, ILLINOIS 60035

Mr Francis T Mayo
Federal Water Quality Administration
33 E. Congress Parkway
Chicago Ill 60605

Dear Sir:

I urge that the strictest standard of thermal control be adopted at the Enforcement + Conference meeting to be held shortly in Chicago - that announced by the Department of the Interior. This is a matter of utmost urgency

Yours truly,
Lucy M. Barr

Mr. Francis T. Mayo
Regional Director Federal Water Quality Control Administration
33 E. Congress Parkway
Chicago, Illinois

Dear Mr. Mayo:

DO NOT PLUNGE US INTO HOT WATER!

THERMAL POLLUTION
is the
deleterious change in the normal temperature of water caused by the discharge of waste heat.

THE RISK OF TAMPERING WITH THE LAKE MAY CAUSE THESE DISASTROUS EFFECTS.

1. Kill fish
2. Speed the aging or eutrophication (decrease the oxygen) process of the lake

by
Favoring growth of algae, bacteria and other pollutants.

THERE ARE MANY POSSIBLE WAYS TO CONTROL THERMAL POLLUTION
such as
cooling towers, cooling ponds and closed cooling systems.

Do not let ANY INDUSTRY DELUGE US WITH EXCUSES that cooling plants would be too expensive. Only the loss of human life is too expensive.

Set a strict standard for the temperature of natural waters--no more than one degree rise in temperature.

Sincerely,

Name
Address 4811 S. E. Ellis
City Chicago. Ill. 60615

NOTE: The above letter was received from the above-signed individual as well as those on the following two pages (2343 and 2343).

Helen Kutojov
5493 Cornell
Chicago, IL

Karel Wolfson
5210 Dorchester
Chicago, IL

Mr. & Mrs. R. V. Weclew
5429 South Harper
Chicago, IL 60615

Diehl Cohen
1357 E. Park Place
Chicago, IL

Brian Dosch
5403 Woodlawn
Chicago, IL

Bruce Fischer
1414 E. 59th St.
Chicago, IL

Nancy Stetton
5950 Dorchester
Chicago, IL

Jean Spencer
5201 South Cornell
Chicago, IL

Mrs. Seals Sayles
1337 Beechwood Boulevard
Pittsburgh, PA 15217

Marc Kaplan
5112 Hyde Park
Chicago, IL

Alice Rubovits
4940 East End Avenue
Chicago, IL 60615

Weiland F. Buchanan
5555 Blackstone
Chicago, IL

John D. Alexander
6219 S. Chapel
Chicago, IL

Evelyn C. Trugran
1606 E. Hyde Park
Chicago, IL

Joyce A. Solomon
1410 S. Rockdale Place
Chicago, IL 60615

Harvey Mantel
1005 E. 60th Street
Chicago, IL 60637

J. Albrechs
1462 E. Park Place
Chicago, IL 60637

K. Majewaki
5314 Cornell A
Chicago, IL

Diane Broadbart
5824 Kimbark
Chicago, IL

Paula Foster
5749 Dorchester
Chicago, IL

Marjorie Feren
5738 Blackstone
Chicago, IL

Pam Emil
5450 East View Park
Chicago, IL 60615

Helen Bergstrom
5405 S. Woodlawn
Chicago, IL

Judith A. Baer
5345 S. Ellis Ave.
Chicago, IL

Pamela H. Pearson
5541 1/2 Woodlawn
Chicago, IL 60637

Ann Palkovich
5824 S. Kimbark
Chicago, IL

Mary Kay O'Brien
5824 S. Kimbark
Chicago, IL 60637

Eric Anderberg
4821 South Ellis
Chicago, IL 60615

Robert E. Mann
5539 S. Horner
Chicago, IL 60637

DEDICATED TO THE PRESERVATION OF OUTDOOR AMERICA

The Izaak Walton League of America

PORTER COUNTY CHAPTER, CHESTERTON INDIANA 46304

To: Federal Conference on Lake Michigan and Its Tributary Basin,
Federal Water Pollution Control Administration,
October 2, 1970

Submitted by: Ted Falls, Pres., Porter County Chapter, Izaak Walton League,
Wheeler, Indiana 46393.

Gentlemen:

I would like to offer these observations on some of the papers presented to the Conference this past few days, to stand on their own merits and without further qualifying myself. I must take personal responsibility for the technical matter here presented, but my Chapter stands committed to the position I state.

My first reference is to the discussion of the value of Dr. Peter J. Colby's laboratory work on the effect of temperature on the time for hatching eggs of one species of whitefish. Dr. John C. Ayres has condemned this work in a widely published paper, and made reference to this position in his talk before this Conference. "Evidently, nature knew something important that did not bear in the laboratory-tank experiments, but what was it?" he wrote. "Patently, laboratory-tank biology was not what was going on in that warm-water plume." A remarkably strong effort was made, in the questioning following Dr. Colby's presentation to this Conference, to discredit his work as inapplicable to actual Lake conditions.

There was an important point to Dr. Colby's work that was not brought out in the discussion. So long as temperature remains within certain boundaries, the fundamental process of germination responds to temperature so as to increase the rate of germination as temperature increases above the lower boundary, then decreases as the upper boundary is approached. The relationship of temperature and time is non-linear. A study of the temperature effect on a particular species in the laboratory will permit the determination of a temperature-time constant for each temperature, provided that all other factors are controlled to duplicate the conditions in nature. In a field application of laboratory findings, two things will be verified: the applicability of the temperature-time constant, and the precision by which the other conditions of nature were duplicated.

To discover the values in a curve it is necessary to measure at least four points, preferably five, if the curve is always rising, or always falling. It is of the utmost importance to learn if Dr. Colby used this technique. In fact, the curve he studied rises to a peak as temperature increases, then falls as it approaches the upper limit of temperature. With this in mind, Dr. Colby evaluated nine points in a 12 deg. C range. This gave him, in essence, five points for each direction. His result was a continuity of the temperature-time constant useful for field application.

Nature sums the temperature-time constants through the succession of temperature changes, producing a hatch when the sum reaches its proper point. Every farmer, and most students of biology are aware of the occurrence of early and late crops in different years due to the vagaries of weather, and correctly recognize the importance of temperature in this effect on the many functions of plant and cold-blooded animal growth. When Dr. Colby turned to the field, it became necessary to measure the succession of temperatures in order to sum the temperature-time constants he found in the laboratory, which he did. The 98% precision he claims is an achievement of the first order: a 90% precision would be highly credible, and useful in future predictions.

We are able to observe the temperature-time effect in many phases of plant and cold-blooded animal growth. The phenomenon has been discussed in scientific literature for two or three generations. For many years it has been roughly approximated in the mean annual temperature of the region. Hence, the northern boundary of the growth of wild palmettos in the Carolinas has been related to an isotherm stated to a tenth of a degree, soil conditions being equal; and the development of these plants increases southward as the mean annual temperature increases. Spanish moss grows wild at the southern tip of New Jersey along the coast due to the warming effect of the Gulf Stream, far north of its normal habitat: the mean annual temperature indicates a suitable sum of the temperature-time constant within the boundaries required by this plant.

Each species has its own temperature-time constant and boundaries. When nature has established a regular succession of temperature changes, with only minor variations from year to year, various species will become established according to their adaptation and adaptability. The fact that there are local, natural temperature changes of the waters of undisturbed Lake Michigan is irrelevant: these are normal for each season, and are repeated year by year. They are within the boundaries tolerated by the species that have become established. When the temperature-time summation and the temperature boundaries are changed, there will be changes in response of established species; and as the factors change progressively there will be changes in the species present.

It is obvious, with a cursory inspection of the shoreline of Lake Michigan, that the present undisturbed Lake is at the lower boundary for growth of certain algae. A mile away from the present Michigan City power plant there is a growth of algae on piles and rocks that has appeared in the last ten years, and was never there before. That there is a probable increase of temperature is confirmed by several statements to this conference, reporting the results of careful studies. The vigor of the growth of algae increases as the power plant is approached, and is rank close to the outfall where the temperature-time summation is greatest. It is true that there is a discharge of nutrients from the Michigan City sewage disposal plant on Trail Creek, and from the nitrates formed in the combustion chamber of the power plant. We would expect the dispersal of the nutrients into the outer waters of the Lake to be much slower than the dissipation of the heat, favoring a more uniform growth of algae along the shore if heat were not an effective factor.

I hold that Dr. Ayres is greatly mistaken to attack the validity of the work of Dr. Colby, and that he has failed to take into account directions for study that are of the greatest importance in evaluating the impact of huge quantities of heat on Lake Michigan.

There are certain characteristics of a plume that seem to be ignored or not realized in most of the discussion of this Conference. The water of the plume moves through it at a relatively rapid pace, disappearing eventually in the body of water in the Lake. The plume is persistent, for it is continuously supplied. The plume wanders over a fixed area greater than that of the plume itself, in a slow march as it is affected by currents.

The rapid rate of flow within the plume has a direct effect upon the water-borne planckton and nymph stages that might be caught within it. These forms do not have the means of locomotion to move out of it with any rapidity. Such as may survive the heat shock of the passage through the condensers do not have time to increase before they are swept into other waters in the Lake, where they join their fellows. The question of eventual survival, having withstood the condenser shock, is an easy one to answer, for a sample can be taken almost without contamination by unshocked individuals from the surrounding water. These can be studied in the laboratory tank under optimum conditions, comparing them with samples from the surrounding Lake as a control. In the papers given I missed a comparison of samples from the condenser discharge and from the area close before the intake, to show the immediate effect of heat shock,

I would like to quote from the article by Dr. John C. Ayres entitled "Remarks On Thermal Pollution In The Great Lakes", a passage in the Position Paper distributed by NIPSCO in August and subsequently: In the plume "there was no cloud of excess algae in the warm water and no aquatic insects emerged for mating flights into air that was too cold to let them fly". Dr. Ayres forgets, or chooses to ignore, the fact that the temperature-time constant summation for the time to pass through the plume is very nearly zero in the division cycle of algae and in the life cycle of aquatic insects.

The persistence of the plume is another matter, affecting all the fixed life forms that it can reach. In this category are the forms of algae that grow attached to stationary objects, and the fish eggs attached to the bottom or to debris locked to the bottom. These are subject to shorter or longer exposure to temperature from the plume, responding to the temperature-time constant and the boundaries. The effect is very real, and under certain conditions must be deleterious.

The wandering of the plume negates the conclusions based on the concept that the plume is a fixed body, and gives us a key for an analysis by which we can predict the effect with some accuracy. Since the response of fixed life forms is the summation of the temperature-time constants, the analysis of a plume should be a mapping of the area over which it will flow in the course of time, taking into account the temperature-time factor. This will show the true area affected by the plume: heat-sensitive pictures of a plume at any instant are deceptive.

In Dr. Donald W. Pritchard's paper, the concept of the plume in Case IV is very attractive on first consideration. There are several controversial points, however. No doubt Dr. Pritchard made sure that there is enough energy in the stream at the outlet to create the turbulence that is the key to the reduction of temperature that he predicts. This is the essential factor in his proposal.

It is important to picture the nature of turbulence to evaluate this proposal. There seem to be several conditions of flow in a turbulent fluid body: vortices of great and small dimensions; sheets of varying thickness and shape, and of short duration; and pencils of odd shape of cross-section and varying dimension and persistence, all forming and reforming progressively outward from the source. One can see the process in slow motion in cigarette smoke floating in a shaft of sunlight in an apparently still room: in a space of such large dimensions there is turbulence even though we are not aware of it by the feel on our skin. In the case that Dr. Pritchard sets up, turbulence will be rapid and massive.

In turbulent water, the laws of heat interchange will still apply. Bodies of water will interchange heat as they are mixed, assuming the median temperature, just as in the mixing of cups of water in the High School laboratory. This means that there will be a temperature gradient from the discharge stream outward, just as in any plume, considering temperature measurement with ordinary instruments that average the condition in the medium in which they are immersed. An instrument capable of instant response, fixed in a flowing plume, would show a rapidly fluctuating temperature as the various vortices, sheets and pencils pass by. The range of the temperature fluctuations would decrease as the instrument is moved outward from the initial stream.

In this turbulent body planckton entrained in the original stream will be caught in the turbulence as the stream "peels off". Mostly, they will follow the bodies of water involved in the process of dispersion, suffering such temperature change as might occur in the mixing process. Some will transfer directly from warm water to cooler water adjacent, perhaps a temperature shock. Further, all planckton entrained in the cool water drawn into the turbulence will in their turn be subjected to a sharp temperature change as their water is mixed with the warmer water from the initial stream. This temperature change will be graded according to the temperatures involved. Some of it will be extreme. All in all, it seems that more destruction of planckton will occur in Case IV than in any other proposal. Unfortunately, the case is offered to justify the highest temperature discharge of any of the several methods.

Dr. Pritchard is quite correct to predict that the highest temperature to reach the surface will be materially reduced from the temperature at the discharge point. The average temperature of the plume at the surface will be much less than that of a flume spreading the hot water over the surface. The consequence of this is that heat dispersion to the atmosphere by radiation and evaporation will be reduced: a greater quantity will be retained in the Lake. In turn, the summation of the temperature-time constant will be effective over a greater area of the Lake.

Further, turbulence is induced over 360 degrees of the section normal to the direction of the originating stream. This means that heat will reach the bottom of the Lake as well as the top. This will affect any plant or animal life that might inhabit the area.

From the consideration of the heat effects of Case IV, we cannot accept the proposal as a likely solution of the heat problem in Lake Michigan.

In our personal experience we have learned that there is more chance that an unforeseen gimmick will destroy an attractive idea than that the idea will be successful. With this in mind, we have scanned a number of possible side effects that might develop in the application of Case IV. Two need to be examined. There is a possibility that a hydraulic jump will form near the end of the jet of hot water before it is entirely dissipated. It can be avoided by controlling the velocity of the discharge: it could very well be that the planned velocity will not be of a value to produce the condition. More likely is the possibility that the discharge from the pipe will produce a rip. Both will be a hazard to small power boats that will want to use the area. These and other problems can be resolved by a model study.

We are intrigued with certain aspects of the economy of power production. The heat discarded by a power plant is money, as was remarked this week. Looking at this cursorily, a fossil fuel power plant with a revenue of $500 million annually for the sale of electric power is discarding a potential market value of $563 million or more, and spending money to do it, if electric power is truly competitive with other forms. For a $500 million annual revenue from nuclear

nuclear power, the value of the power discarded becomes more than $1 billion annually. These values must not be confused with the actual cost of the power discarded, which, of course, is much lower but still formidible. In either case the gold vein is worth prospecting. The electric companies have been peculiarly reluctant to develop and market by-products. Revenues from the discarded heat amounting to only 20% of the above figures will support a heavy investment in research and plant.

We believe that the ultimate development of power companies will be to locate in the center of an industrial park, surrounded by heat consuming industries, or other heat consuming activities requiring space. With proper planning there will be the necessity for a relatively small dry cooling tower to balance the demand for heat with the demand for electric power. By locating on a lake shore a power company is reducing its area **for** this option by half; located on the lake shore between a large public park and a high level residential community, the option is barred entirely.

Considering that the evidence is clear that heat degrades Lake Michigan in more than a small degree, and that the increase in generation of electric power, coupled with the additional heat discarded by industry will approach and exceed the tolerance of nature; and considering also that the proposals offered for the control of heat disposal are inadequate, we take the position that it is correct to limit all discharge of water to a delta T of 1 degree. We think that industries that cannot meet this specification should locate elsewhere. We feel very keenly that Lake Michigan is of the greatest value as we found it, and that it should be preserved.

AMERICAN ELECTRIC POWER Service Corporation

AEP

2 Broadway, New York, N. Y. 10004
(212) 422-4800

October 8, 1970

To The Conferees
The Lake Michigan Enforcement Conference

Mr. Murray Stein, Chairman
Mr. David Currie
Mr. Thomas Frangos
Dr. F. T. Mayo
Mr. Perry Miller
Mr. Ralph Purdy

Gentlemen:

At the conclusion of the Workshop Session of the Lake Michigan Enforcement Conference, on Friday, October 2, you heard discussion of a vital point that needs further consideration. This was the dialogue on who should bear the responsibility for measuring the effects of warm water discharges. Chairman Murray Stein and Dr. M. A. McWhinney set forth only part of the problem. In this matter, as an observer of the five days of your Workshop, I would like to present additional comments.

The bearing of responsibility should be recognized for two purposes - for enforcement, and for support of a permit of use. For an enforcement action, many states have laws that require that the enforcement agency must obtain and present the technical evidence used to judge and convict a violation. For the use of a resource such as a public water, many states insert into permits for withdrawal or for discharge, the requirement that the user must obtain and submit suitable observations to determine whether or not he is doing harm by the specified use; and these states reserve the right to withdraw or revise the permit if harm is found. In the discussion between Chairman Stein and Dr. McWhinney, there may have been some confusion as to which type of responsibility was to be borne by whom.

Certainly, the federal agencies and the state agencies should collect and present evidence used for any enforcement action. In addition, they should maintain a degree of observation sufficient to verify the conclusions offered by the user from his own studies.

It should be required that the user of a resource bear the burden or the responsibility of supporting sufficient evaluation and research to show that no harm is done by his use. This evaluation and research should be according to advance plans that have been approved by the agency that is authorized to permit the use.

It is often to the benefit of the whole community to have a third-party evaluation - a citizens group that is free of the possible biases of the permit issuer and the permit recipient.

The type of study or research and the processes of decision are often confused. Should these be investigations using all of those scientific disciplines that should be applied? Should the validity of judgments of these scientific studies be subject to legal review? Or, should the rule of "the street people", the pressure of hysteria, replace such deliberative actions? Last week, we heard intimations of unlawful actions if the governmental agencies did not move quickly and to the satisfaction of the "street people."

Should the scientists be considered as capable of maintaining objectivity without regard to the source of their financial support? We have heard a great deal of talk suggesting that any scientist who accepts support from an electric utility is bound to find biased data in his studies, and to give dishonest conclusions. We have heard this claimed even in cases where the utility paid no money directly to the scientist but only had a contract with his university. Such a financial contamination process could be applied to other scientists from the same university - even to those who have expressed contrary conclusions.

If the utility will contaminate any scientist whose university accepts a research contract with the utility, and if the utility will contaminate any scientist who works more directly for the user, how can the utility find out the truth? And, how can it obtain evidence showing whether or not it does harm by its use?

If financial support is a basis for disqualification of scientists, how can either side of a dispute present expert testimony? Will only the expert testimony of third parties be allowed?

Chairman Stein and Dr. McWhinney touched on a little of this, in their noteworthy discussion in Chicago.

In many cases today, the electric utility is required to support elaborate research by experts who were approved in advance by the responsible agencies. Then, the work done by these experts is checked by various of the government experts. This process is yielding a vast amount of honest information on the effects of warm discharges. This process should be continued - and even expanded.

Very truly yours,

T. A. Miskimen

T. A. Miskimen
Senior Engineer

TAM/fkr

2353

MRS. MAXWELL McCROHON
ROUTE 1, STUENKEL ROAD
CRETE, ILLINOIS 60417

September 30, 1970

Dear Mr. Mayo;

Please be vigorous in opposing any installations along our lakeshores which discharge water heated more than one degree over the normal lake temperature.

I am also disturbed about the improper land use which accounts for industries situating on disappearing scenic and recreational waterfrontages which are already inadaquate to the burgeoning metropolitan populations.

By denying the privalege to private companies to make use of the lakeshores there will be more impetus to finding adaquate alternatives.

Thank-you very much for your kind attention.

Very truly yours,

Nancy McCrohon

2354

Mrs. **DAN HARPER** · BOX ~~216~~ 32, ROUTE 3, CRETE, ILLINOIS

604 7

October 1, 1970

Mr Francis T Mayo, Dir G L R.O.
U S Dept. of the Interior F W Q A
33 East Congress Pkwy Room 410
Chicago, Ill. 60605

Dear Mr. Mayo,

Please hold fast to the standard announced by the Department of the Interior last spring, that heated water discharged into Lake Michigan not exceed 1°F. over ambient at the point of discharge. Let us not be permissive with this precious and irreplaceable resource.

Yours very truly

Jean Harper

ROBERT McCLORY
12TH DISTRICT, ILLINOIS

JUDICIARY COMMITTEE

SUBCOMMITTEES:
ANTITRUST
SUBMERGED LANDS

MEMBER:
U.S. INTERPARLIAMENTARY
UNION DELEGATION

Congreſs of the United States
House of Representatives
Washington, D.C. 20515

ROOM 426 2355
CANNON HOUSE OFFICE BUILDING
(202) 225-5221

DISTRICT OFFICE:
POST OFFICE BUILDING
326 NORTH GENESEE STREET
WAUKEGAN, ILLINOIS 60085
(312) 336-4554

September 9, 1970

The Honorable Carl Klein
Assistant Secretary of Interior
Department of Interior
Washington, D. C.

GR

Dear Mr. Secretary:

It has come to my attention that conferences will be held in Chicago from September 28 through October 2 to consider a new Federal policy directed against Thermal Pollution of the waters of Lake Michigan. At the time of the application for authority to erect the nuclear power plant for Commonwealth Edison at Zion, Illinois (in my Congressional District) I called attention to the need for careful study and resolution of the Thermal Pollution problem.

Notwithstanding the Commerce Department and AEC approval of this application, the various charges persist that a dangerous level of heated waters will be discharged into the Lake with possible adverse effect on marine life and other appropriate uses of the Lake waters. While it would appear to be most unreasonable at this juncture to impose new standards which were not anticipated by Commonwealth Edison Company at the time its nuclear generating project was initiated, I feel it is entirely appropriate to require that company to utilize such technology as may reduce to a minimum the heat which may be involved with effluents from its nuclear generating plant. It is my further hope that your hearings may lead to information or research which can eliminate thermal pollution entirely.

I regret that I will be unable to attend your conferences personally. However, I hope to have a representative present and that I may subsequently receive a report of the conferences which you have arranged.

Sincerely yours,

Robert H McClory

Robert McClory, M.C.

RMcC/gc
cc: The Hon. Clarence W. Klassen, Director, Ill. Environmental Protection
Agency.

JAMES SLOSS
605 SKOKIE LANE
GLENCOE, ILLINOIS 60022

September 26 1970

Mr. Francis T. Mayo
Director, Great Lakes Regional Office
U.S. Department of the Interior
Federal Water Quality Administration
33 East Congress Pkwy, Room 410
Chicago, Ill 60605

Dear Mr. Mayo

I am writing to ask for your support of stringent thermal pollution standards for Lake Michigan to be considered at the forthcoming Federal-State Enforcement Conference to be held from September 28 through October 2nd.

In view of the many nuclear power plants being constructed or proposed on Lake Michigan's shores, the cumulative effect of establishing anything less than the most stringent thermal discharge standards would have disastrous effects on Lake Michigan and its environs.

I hope it is deserving your earnest consideration.

Sincerely yours,

James Sloss

Sept 25, 1970

MRS MAYNARD J SEIDMON
1064 Skokie Ridge Drive, Glencoe, Illinois 60022

Dear Sir –

At conference to begin Sept 28 – I urge adoption of strictest standards possible concerning thermal pollution of Lake Michigan

Sincerely,

Mrs M. Seidmon

AARON S. WOLFF
11 SOUTH LA SALLE STREET
CHICAGO 60603

AREA CODE 312
FRANKLIN 2-5461

September 24, 1970

Mr. Murray Stein, Conference Chairman
Federal Water Pollution Control Administration
Department of the Interior
Washington, D. C. 20242

Dear Mr. Stein:

Since you are Conference Chairman of the Federal Water Pollution Control Administration, I strongly urge that you do all in your power to avoid thermal pollution of Lake Michigan. At the forthcoming Federal-State Enforcement Conference on pollution of Lake Michigan, I certainly hope that you will push for adoption of the strictest standard under consideration. This would be that of the Department of the Interior which would sanction only the minimum possible waste heat to be discharged into Lake Michigan or a 1° F. rise over ambient at the point of discharge, whichever is less.

Very truly yours,

Aaron S. Wolff

Aaron S. Wolff

ASW:sf

AARON S. WOLFF
11 SOUTH LA SALLE STREET
CHICAGO 60603

AREA CODE 312
FRANKLIN 2-5461

September 25, 1970

Mr. Francis T. Mayo, Director
Great Lakes Regional Office
U. S. Department of the Interior
Federal Water Quality Administration
33 East Congress Parkway - Room 410
Chicago, Illinois 60605

Dear Mr. Mayo:

Since you are the Director of the Great Lakes Regional Office, I strongly urge that you do all in your power to avoid thermal pollution of Lake Michigan. At the forthcoming Federal-State Enforcement Conference on pollution of Lake Michigan, I certainly hope that you will push for adoption of the strictest standard under consideration. This would be that of the Department of the Interior which would sanction only the minimum possible waste heat to be discharged into Lake Michigan or a 1° F. rise over ambient at the point of discharge, whichever is less.

Very truly yours,

Aaron S. Wolff

ASW:sf

9-25-70 Enf. 96

MRS. LYMAN BARR
1005 WADE STREET
HIGHLAND PARK, ILLINOIS 60035

Mr Murray Stein
Federal Water Pollution Control Adm.
Department of the Interior
Washington D.C. 20242

Dear Sir:

I wish to add my voice in urging that the strictest possible standard of thermal control be adopted at the Enforcement Conference on pollution of Lake Michigan. I believe this to be of the utmost importance and urge you to do everything possible to bring this about.

Yours truly,

Lucy M. Barr

Enf 10/2
cnm

2361

F. SCAMMON BARRY, M. D.
1761 RIVER DRIVE
GLENVIEW, ILLINOIS
GL 4-5353

Sept. 27,1970

Mr. Murray Stein, Chmn.
Federal Water Pollution Control Adm.
Dept. of the Interior
Washington, D.C. 20242

Dear Mr. Stein:

I urge you to use all of your influence to get the 4-state Enforcement Conference on Pollution of Lake Michigan to adopt the strictest standard under consideration for thermal pollution. I believe this is the standard announced by the Dept. of the Interior.

This opinion states: "the minimum possible waste hear shall be added to the waters of Lake Michigan. In the event will heat discharges be permitted to exceed a 1 degree rise over ambient at the point of discharge. This will preclude the need for mixing zones."

Yours truly,

F. Scammon Barry M.D.,

F. Scammon Barry

Lake St. Clair Anti-Pollution League
P. O. Box 63
St. Clair Shores, Michigan 48080

Mr. Murray Stein
Chairman
Lake Michigan Enforcement Conference
c/o FW/QA
33 E. Congress Parkway
Room 410
Chicago, Illinois 60605

Dear Mr. Stein:

We wish to thank you for this opportunity to express our views regarding thermal pollution of Lake Michigan. As you may know the pollution of our lakes, rivers, and oceans is of primary concern to our group.

It is our contention that pollution in any form is detrimental to the health and well being of the citizens of this country and the world, and is becoming quite acute. The argument that only a small amount of hot water will be dumped into Lake Michigan will not, so to speak, hold water. This pollution added to all the other pollutants that are being dumped into the lake will only make the problem worse. As noted in the Clean Water News , thermal pollution will, according to a report from the U.S. Department of the Interior, have a significant adverse ecological effect on the lake.

We feel therefore that thermal discharge into Lake Michigan should not be condoned or allowed. As there are cooling systems available which will apparently work and are feasible to use, we feel adequate cooling systems should be made manditory for water cooling before dumping into the Lake. Careful site selection surveys should be made to prevent other potentially dangerous ecological changes from occuring.

Thank you again for this opportunity.

1024 Palmer Place
Waukegan, Illinois 60085
September 27, 1970

Murray Stein,
Federal Water Pollution Control Administration
Department of the Interior
Washington, D.C. 20242

Dear Sir,

This is a letter from an ecology-minded Lake Michigan citizen concerning the installation of nuclear reactors by Commonwealth Edison around the lake and with the thermal pollution threat. I wish to express my opinion that these nuclear plants must not be deployed. Lake Michigan is already in enough trouble without this new threat of temperature rise and radioactive accident. If the atomic plants cannot be stopped (alas, they have already started!!), then at the very least the one-degree above lake water temperature standard recommended by the Department of the Interior must be upheld and rigidly enforced. Already, at various times, the beaches here in Waukegan have been closed, as in other Lake Michigan communities. But the beaches aren't the most important thing. It is life, itself, that is threatened, the life of Lake Michigan, the life of its fish and other animals, its plants, and eventually the chain including the life of man. He too is threatened. It's time we started realizing the dangers of pollution caused by a monopolistic politically-powerful electric company are more real than they would have us believe.

Sincerely,

Michael C R Renne

September 28, 1970

Mr. Murray Stein
Conference Chairman
Federal Water Pollution Control Adm.
Dept. of the Interior
Washington, D. C. 20242

Dear Mr. Stein:

I would like to voice my support for the establishment of strict standards controlling heat discharges into Lake Michigan and other waterways. There should be no difference in waterway and discharged water temperature that cannot be attributed to error in measurement.

It is time to take decisive action. Caution must be exercised now. It is easier to ease restrictions in light of future findings than it is to view useless bodies of water and wish there had been more foresight.

Yours truly,

E. M. Davey

Flint Mich
Sept 29/70

Dear Mr Stein:-

Regarding thermal pollution of Lake Michigan, why don't they heat the water to steam, discharge it into the air, let the vapor fall into a pond then run that water thru a pipe deep into the ground before emptying into Lake Michigan.

It does not seem like they would want to do less than that.

Yours very sincerely
Alfred H. Winters
Flint, Mich.

Holder of 3 mechanical instrument patents 2 U.S. one Canada

Summary
Preliminary Report on Sanitary Sewerage System
and Water Pollution Control Facilities
Whiting, Indiana

Engineer - Russell, Schubert, Hamilton and Associates, Inc., Indianapolis

Receiving Waters

1. Existing (a) Dry weather flow to Hammond for treatment with effluent discharge to Grand Calumet River west to Illinois Waterway.

   (b) Combined sewer overflow (intermittant) to Lake Michigan. Storm water pumping station discharge to Lake Michigan.

2. Proposed (a) Plan A & B - Dry weather flow to Hammond, storm water disinfected and discharged to Lake Michigan.

   (b) Plans C, D and E - All flow treated and discharged to Lake Michigan with alternate for discharge to Indiana Harbor Canal.

Estimated Cost

Plan A and B - $7,043,000 and $7,022,000, respectively
Plan C, D and E - $6,241,000, $6,360,000 and $5,388,000, respectively
Alternates for discharge to Indiana Harbor Canal $260,000 to $380,000

Discussion

Whiting is served by a combined sewer system. The dry weather wastewater flow from the City of Whiting is discharged to the Hammond Sanitary District at the Robertsdale pumping station for treatment by Hammond. This procedure has been in effect since the late 40's. An overflow at one point in the Whiting sewer system near the Lake discharges to the Lake when the lift station malfunctions or when the sewer downstream from the lift station is surcharged. Whiting also maintains a storm water pumping station near the Robertsdale pumping station. At times of runoff from rainfall, storm water is discharged to Lake Michigan.

The implementation plan of the Water Quality Standards required Whiting to provide treatment and disinfection of sewage and storm water overflow on or before the end of 1970. When it became obvious that the City would not meet this schedule, the Board scheduled and issued an administrative order to provide the necessary facilities - the final order which was issued on July 21, 1970, provided for completion of a project to provide for treatment and disinfection of sewage and storm water overflow by May 1, 1971. The order also recommended that Whiting continue to pump its wastewater to the Hammond Sanitary District.

Reproduced from best available copy.

Proposed Project - The preliminary report which was received on September 8, 1970, (draft copy received August 24) provides information on 5 plans and recommends Plan E as the most favorable.

1. Plans A and B which are essentially the same, provide for separation of the sewer system with discharge of wastewater to Hammond and disinfection of storm water with discharge to Lake Michigan. The sewer separation construction cost is estimated to be in excess of $3,000,000.

2. Plans C, D, and E propose minor improvements to the sewer system, a 3 mgd activated sludge-type treatment plant and a 30 mg storm water detention basin, with provision for treatment of storm water at the rate of 1 mgd prior to discharge of effluent to Lake Michigan. Alternates are indicated for tertiary treatment at an estimated cost of $500,000 and discharge of the effluent to the Indiana Harbor Canal in lieu of to Lake Michigan.

Comments -

1. Sufficient detail is not provided on the proposed treatment facility and tertiary treatment under plans C, D, and E to determine whether or not the cost estimate is feasible.

2. Sufficient data are not provided on storm water runoff to assure that a 30 mg storage basin is adequate to retain all flows with treatment capability of only 1 mgd above dry weather flow.

3. Cost data is not provided on estimated operation and maintenance costs in order to compare the annual cost to Whiting if it built its own plant with the cost of continuing to discharge to Hammond.

4. No information is provided on the feasibility of utilizing the sewer plans and detention basins as proposed under plans C, D, and E with discharge to Hammond on a scheduled basis rather than construction of a plant by Whiting.

5. The report compares the construction cost only of Plan E with the construction cost and treatment charge by Hammond.

6. There are inconsistencies and obvious errors in the report so that a proper evaluation of all aspects is not possible.

7. The proposal by Whiting to provide its own treatment provides for direct discharge to the Lake or via the Indiana Harbor Canal. Whiting's plan is not compatible with the requirement for regional pollution abatement planning or the general premise that additional effluents not be discharged to Lake Michigan, particularly where there is an alternate solution.

Recommendation - That the proposal for construction of a treatment plant by Whiting and discharge to Lake Michigan or a tributary thereto not be found satisfactory.

OHHess
9/30/70

Mrs. **DAN HARPER** · BOX 216, ROUTE 3, CRETE, ILLINOIS

6-417

2367

October 1 1970

Mr Murray Stein
Fed Water Pol. Cont. Adm.
Department of the Interior
Washington, D.C. 20242

Dear Mr Stein.

Please hold fast to the standard announced by the Department of the Interior last spring, that heated water discharged into Lake Michigan shall not exceed 1° F over ambient at the point of discharge. Let us not be permissive with our precious and irreplaceable resource.

Yours very truly,
Jean Harper

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2368

SNA003 (32)(11)MA170
M WKA003 AS PDF WAUKESHA WIS 2 807ACDT
MURRAY STEIN
CARE LAKE MICHIGAN ENFORCEMENT CONFERENCE SHERMAN HOUSE CHGO

FAVOR STAND AGAINST WATER POLUTION. AM OWNER OF BONDS IN CONSUMERS POWER ENVIROMENT MOST IMPORTANT

MRS BETTY PRIEBE

(815).

SF1201(R2-65)

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2369

5A

CHAIRMAN MURRAY STEIN, DLY 75
FEDL WATER POLLUTION CONTROL ADVINISTRATIVE HEARING
SHERMAN HOUSE CHGO

WE URGE YOUR CONTINUED EFFORT TO SET STANDARDS FOR LAKE MICHIGAN AT THE TOLERABLE LIMIT OF ONE PERCENT THERMAL ADDITION ABOVE WATER TEMPERATURE ACCORDING TO SECRETARY OF THE INTERIOR WALTER HICKEL STATEMENT. WE THE GENERAL PUBLIC MAY NOT BE VOCAL BUT YOU HAVE OUR FULL SUPPORT. HAPPY NEW YEAR DEAR MR STEIN TO YOU AND YOURS

STAFF OF VIRGINIAS BEAUTY SALON 406 EAST SILVER SPRING ELEANORE GRACE MANAGER.

SF1201(R2-65)

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SN

SHA002 (25)(10)MC031
M SBA003 SW NL PD SHEBOYGAN WIS OCT 1
MURRY STEIN
SHERMAN HOUSE CHGO

THE SHEBOYGAN CHAPTER OF THE IZAAK WALTON LEAGUE OF AMERICA AND THE SHEBOYGAN CHAPTER MEMBERS SERVING AS OFFICERS AND DIRECTORS OF THE STATE LEAGUE HARDLY ENDORSE THAT THE WATER TERMPERATURE INCREASED BY NUCLEAR POWER PLANT LOCATED ON LAKE MICHIGAN BE HELD TO ONE DEGREE THE STATE LEAGUE IS REPRESENTED BY 2000 MEMBERS AND THE SHEBOYGAN CHAPTER BY 215 MEMBERS

E K BORN PRESIDENT.

SF1201(R2-65)

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2371

MURRY STEIN, SHERMAN HOUSE

CHGO

SN

THE CITIZENS NATURAL RESOURCES ASSOCIATION OF WISCONSIN STRONGLY SUPPORT SECRETARY HICKELS STANDARD OF ONE DEGREE INCREASE IN WATER TEMPERATURE FROM ATOMIC POWER PLANTS

F M BAUMGARTNER PRESIDENT CNRA

(1130).

SF1201(R2-65)

WESTERN UNION
TELEGRAM

SNA005 (33)(15)MB083 CL065
CC SNA004 BY PBC 5 EXTRA SN CHICAGO ILL 2 908A CDT

1970 OCT 2 AM 9 38

2372

MURRAY STEIN, CHAIRMAN, CARE SHERMAN HOUSE
6TH FLR BELL TABERN ROOM CHGO

ADOPT STRICTEST STANDARD UNDER CONSIDERATION SAVE THE LAKE
KEITH A ZIOLEK 1612 OAKTON PARK RIDGE ILL
(913).

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WW SNB002 HH GOVT PDB SN WASINGTON DC 2 1043A EDT 2373

SN

MURRAY STEIN
SHERMAN HOUSE HOTEL CLARK AND RANDOLPH ST CHGO

DEAR MR STEIN:

IT IS MY UNDERSTANDING THAT THE FWQA WILL BE CONCLUDING AN ENFORCEMENT CONFERENCE TODAY CONCERNING THE POLLUTION PROBLEMS OF LAKE MICHIGAN AND THAT THE MAJOR PROBLEM ON THE AGENDA WILL BE THAT OF THERMAL POLLUTION FROM POWER PLANTS.

WHEREAS THE SCIENTIFIC EVIDENCE REGARDING THIS PROBLEM IS ADMITTEDLY INCONCLUSIVE, IT IS MY HOPE THAT IT WILL BE REGARDED AS SUFFICIENT TO PERMIT AGREEMENT ON A SPECIFIC THERMAL STANDARD FOR ALL PLANTS ON THE LAKE. ANY SUCH STANDARD WILL NCESSSARILY BE AN IMPERFECT APPROXIMATION OF WHAT IS NEEDED. YET IT WOULD APPEAR NONETHELESS TO BE AN IMPROVEMENT OVER THE CURRENT SYSTEM IN WHICH DIFFERENT PLANTS ARE HELD TO DIFFERENT STANDARDS OF

The Izaak Walton League of America
INCORPORATED
DEFENDERS OF SOIL, WOODS, WATERS AND WILDLIFE

DIVISION OFFICERS
Sept. 1970–Sept. 1971

PRESIDENT
Wayne Stapl
1334 E. Raymond
Plainfield, Indiana
46168

SECRETARY
Mrs. Barbara Rux
1613 Washington
Michigan City, Indiana
46360

TREASURER
Gale S. Atwood
3625 Lincoln St.
Gary, Indiana
46408

W. CENTRAL & 1st VP
George Leedy
RR2, Box 47
Plainfield, Indiana
46168

WOMEN'S VP
Mrs. [illegible]
939 West [illegible] Ave.
Gary, Indiana
46408

SOUTHWEST VP
John Hornung
RR3, Box 233
Martinsville, Ind.
46151

NORTHEAST VP
Arthur Fishback
260 Manchester Ave.
Wabash, Indiana
46992

E. CENTRAL VP
Wayne Shull
416 W. Foster
Kokomo, Indiana
46901

NORTHWEST VP
John Fred Blosl
5808 E. 10th Ave.
Gary, Indiana
46403

EXECUTIVE SECRETARY Thomas E. Dustin, 1802 Chapman Rd., Huntertown, Ind. 46748 • Ph. 219-637-6264

October 2, 1970

To: Federal Water Quality Administration

Statement of: E. Eugene Minney, President
Interchapter Council
Indiana Division, Izaak Walton League of America
228 N. Raymond
Griffith, Indiana

Gentlemen:

I am E. Eugene Minney, president of the Interchapter Council, an association of Izaak Walton League Chapters in the three northwestern counties of Indiana--Lake, Porter and LaPorte. These are also the Lake Michigan counties of our state, so we know you will appreciate our exceptional interest in this Lake Michigan Enforcement Conference.

In our region of the state are approximately 1200 of Indiana's League membership, the vast majority of whom see Lake Michigan almost daily, and use it recreationally many times each year--for swimming, boating, fishing, and simply enjoying the change of pace which the Indiana dunes region uniquely provides.

We commend the Department of the Interior for recommending a 1°F limit for temperature elevation in Lake Michigan. We would like to observe that there has been a good deal of utility propaganda flowing from this Conference, most of it, we suspect, for public consumption in far off places, and not especially for the edification of the Conference.

Perhaps some of the officials of the four Lake Michigan states may feel you have been overly restrictive in recommending a virtual zero-tolerance for Lake Michigan thermal pollution We don't think so, and we fully and without qualification endorse that recommendation.

If in recommending that tolerance you mean to tell the utilities to move off our Lake Michigan shoreline, and to design inland plant capacity with completely self-contained pollution control systems, then our endorsement is just that much stronger. Because that is what we think they should do also.

The utilities have made much point about choosing between more electricity and the maintenance of high environmental quality. We don't think this is a choice they should be able to make. Lake Michigan does not belong to the utilities; it belongs to all of the people, and we are all entitled to it in an unimpaired condition.

The utilities have produced nothing at all to suggest that their thermal effluents will be harmless to Lake Michigan. And a great deal of expert testimony and documentation suggests that it will be very harmful indeed.

It is not our burden to prove that their activity will further destroy Lake Michigan. We are not dealing in their estate; they are dealing in ours. And this is a distinction the public and its agencies have not made very well in the past. Other than a lone biologist who seems willing to be quoted by the utilities--and whose views have been contradicted by other more independent experts--there is no basis at all for allowing any more utilities to discharge warm water to Lake Michigan.

It would be maddness on our part--raw maddness--to bet the life of Lake Michigan on the say-so of one or two company-retained biologists, who have at very least the appearance of conflict of interest. If our Federal or state agencies allow so much as one more utility or any other industrial installation to add its pipe to the lake, to discharge anything warmer or of poorer quality than natural lake water, then such Enforcement Conferences as this one will no longer have a shred of credibility.

We have not rolled back the wave of pollution here in the past five or six years. The very best that can be said is that the lake is getting worse at a slower rate. This is because neither the people nor their governments at various levels have stood firmly enough. We have rationalized and equivocated.

Let me point out just one evidence of the grave environmental injustice the utilities are expecting all of us to absorb. The National Water Resources Council has predicted an immense increase in water needs by the year 2020. Water development agencies are more than pleased to flash these gross figures around, in order to stimulate public support for the billions of dollars it will take to provide that water. But what the people DON'T realize is that while municipal, agricultural and industrial interests account for a relatively modest part of this increased need, it is the utilities which account for MORE THAN 50% OF THE ENTIRE INCREASE; and that is for cooling steam generating plants. The immense cost of providing that water is to be borne by the public. Why should WE pay for their hot water pollution, and then face them again in an iron ring around Lake Michigan--polluting our water, graying our skies, and uglifying our shorelines.

It is long overdue for a reckoning and a re-balancing of these environmental books. The utilities scream to the people of this land that they must double their capacity every 10 years to stay abreast of demand; then they go forth and create that demand. They ominously forecast blackouts and brownouts when their 19th Century methods of operation are questioned. But if such methods are calculated to pave the way for a new permissiveness toward untreated high-sulphur fuels or a free hand in thermally polluting Lake Michigan, those methods will fail.

The fact is that in environmental engineering the utilities have done a miserable job, born of regional monopolies and other exclusivities. It is too bad we haven't yet come up with a way to put the utilities in the cauldron of competitive economics the way the rest our society has to operate. At this time, we can't buy somebody else's product if we don't want NIPSCO's.

But if we can criticize the utilities--and they have much of it coming--it is also up to all of us to help them make the transition from laissaz faire environmentalism to ecological environmentalism. They are right when they say the cost will be great. They are wrong when they fail to begin creating the atmosphere in which the cost will be acceptable. They are wrong when they oppose every effort to tighten anti-pollution laws; and they have done this, at every hearing in the state of Indiana, where our representatives consistently testify for better conditions.

If the utilities cannot support the clean water and air proposals that Interior and H.E.W. have been making, we would think the least they could do is to relax their fight against these efforts. By following such a course, their position in requiring all of us to help with the costs would be quite understandable and defensible. Their present position can only lead to the conclusion that their primary interest is in corporate profit, not public service. They apparently see themselves apart from the rest of us, instead as a member of the same team.

We will have to recognize our share of the cost burden, but the utilities will have to recognize that the environment they are polluting is not theirs to pollute, but ours--everybody's--to enjoy and live in harmony with.

On September 20, the Indiana Division of the Izaak Walton League--with the full support of our northwestern chapters, adopted a 10-point proposed policy for Lake Michigan. It accompanies the testimony of our state executive secretary, and I will not reiterate it here.

But we feel that policy could be the start of the kind of new attitude toward Lake Michigan which can begin to produce results. Whether some of its points need changing, or other points added, it recognizes Lake Michigan as an integral environmental unit. Our generation MUST stop seeing Lake Michigan as an estate that can be chipped away piece at a time. It must be seen as a whole, and we must soon decide what kinds of activities are acceptable in its context, and what types are unacceptable. ANY more thermal pollution must be judged unacceptable. And 100% effluent standards must be the next goal we set. If are serious--genuinely serious--about saving Lake Michigan, then there are no real alternatives to such a policy.

###

Grand Rapids Mich
10/6
Oct 3 1970
2375

Dear Mr Stein

My hat is off" to you for your efforts in stopping the power companies from continuing their already started "murder" of Lake Michigan. They must be stopped!

I know personally of at least 75 persons who support your views, however, they probably will not write. Therefore I write, expressing the feelings of perhaps hundreds of thousands in Michigan. Lake Michigan is one of the most valuable assets of the people of Michigan and it must not be exploited by the power companies or any other polluter.

Most of us share the common

2375-A

problem of not knowing how to help in the fight against the polluters. I have several suggestions, in addition to writing government and industry officials. I don't believe that it is right of utility monopolies to spend huge sums advertising for more electrical customers, ie home heating, new appliances, etc in view of the population growth. I will write to voice my disapproval. Also I am starting my own personal campaign to reduce electrical consumption.

If everyone would do this, it would take the pressure off the "new plant" frenzy. Incidently I fully approve of 50¢/month for the cooling systems. Cordially yours

L. E. Ward

4433 Jefferson S.E.

Oct. 3, 1970

Mr. Murry Stein,
Federal Water Quality Administration,
Department of the Interior,
Washington, D.C.

Dear Mr. Stein:

I found the following telegram awaiting me when I returned home from the Lake Michigan Enforcement Conference - Oct. 2nd. I was sorry that I did not have it in time to include it in the statements made that day - but would like to have you enter it into the records -

Telegram -

"Regret I am unable to leave Washington to attend the meeting to be held in connection with standards to prevent the further pollution of Lake Michigan on October 2nd at the Sherman House.

Wholeheartedly support a program to make certain that no significant heat be allowed to enter the lake from Nuclear Plants. As my activities in the past have demonstrated, particularly as they apply to halting the dumping of dredgings into the Lake by the Corps of Engineers, reflects my deep concern with the problem of pollution not only of Lake Michigan but all the Great Lakes. Please feel free to call upon me at any time if I can be of assistance in my capacity as an Illinois Congressman in pursuit of efforts to improve ecological conditions."

Congressman Harold R. Collier
10th District - Illinois

Do hope something constructive and positive comes out of that meeting - to assure the safety of the Lake. The loss of it would be a major catastrophy for millions of people!

Sincerely,

The time to take action is now!!

MRS. J. F. VOITA
229 North Taylor Ave.
Oak Park, Illinois 60302

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

L. P. Voigt
Secretary

BOX 450
MADISON, WISCONSIN 53701

October 8, 1970

Mr. Murray Stein
Assistant Commissioner
Federal Water Quality Administration
Department of the Interior
Washington, D. C. 20242

Dear Mr. Stein:

Enclosed is a copy of a statement of the Wisconsin Wild Life Federation submitted by Mr. Les Woerpel of Mosinee, Wisconsin.

I would appreciate your including this statement in the record of the workshop sessions of the Lake Michigan Enforcement Conference.

Very truly yours,
Division of Environmental Protection

Thomas G. Frangos
Administrator

Enc.

Wisconsin Wildlife Federation
Affiliated with
National Wildlife Federation

Post Office Box 7, Mosinee, Wisconsin 54455

September 30, 1970

STATEMENT TO BE ENTERED IN THE CONFERENCE IN THE MATTER OF POLLUTION OF LAKE MICHIGAN.

The Wisconsin Wildlife Federation would like, first of all, to express it's approval of the United States Department of Interior's proposed regulation not to allow waste heat discharges into Lake Michigan to exceed one degree Fahrenheit rise over ambient at the point of discharge.

The question of thermal pollution must be decided now, because, if a tight limit is to be kept on heat discharges into the lake the pattern of building future plants will be affected, and it may be equally as economical to build plants in other locations than on the shores of ready water supplies. If Power plants are permitted to discharge waste heated waters into the lake the precedent will have been set for future concentrations of these plants around the lake. If allowed to dump heated wastes more leniently the time will surely come when the orders will have to be tightened up, and it will be next to impossible to secure compliance with desired waste heat discharge goals.

Regarding Industrial and Municipal discharges of wastes into Lake Michigan or any of its tributaries, the Wisconsin Wildlife Federation has long been on record that they should be mitigated and stopped as soon as is humanely possible. No material progress in cleaning up these waters can be made with a lienient attitude toward polluters, whether of private or governmental origin. An example is the doubling of the solid waste load in the Wisconsin River over the past ten years, a period when everyone thought great effors were being exerted to cut the amounts of such wastes being discharged into the river. We therefore urge that every effort be made by the various state pollution agencies and the Department of Interior to set standards which can realistically attain a goal of lower discharges into the waters of Lake Michigan and its tributaries in a reasonable period of time, And that the goal not be reduced percentages of waste from a plant or municipality, but reduced total discharge regardless of expansion of operations.

Signed: Les Woerpel.
Les Woerpel, Secretary
Wisconsin Wildlife Federation.

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

SPRINGFIELD, ILLINOIS 62706
AREA 217 - 525-6580

October 9, 1970

Mr. Murray Stein
Conference Chairman
Lake Michigan Enforcement Conference
United States Department of the Interior
Federal Water Pollution Control Administration
Washington, D.C. 20242

Dear Chairman Stein:

The authors of the enclosed letters were unable to be present at the September 28 - October 2 Workshop relative to the question of thermal discharge into Lake Michigan. They therefore would like to have these letters made a part of the official record of the Workshop.

Sincerely,

CW Klassen

C.W. Klassen,
Director

Encls.

Mrs. JOAN HARPER · BOX 218, ROUTE 3, CRETE, ILLINOIS
60417

October 1, 1970

Mr. Clarence Klassen
Ill. Env. Pro. Ag.
535 West Jefferson St
Springfield Illinois 62706

Dear Mr. Klassen,

Please hold fast to the standard announced by the Department of the Interior last spring that heated water discharged into Lake Michigan not exceed 1°F over ambient at the point of discharge. Let us not be permissive with our precious and irreplaceable resource.

Yours very truly,
Joan Harper

RECEIVED
OCT 5 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

MRS. MAXWELL McCROHON
ROUTE 1, STUENKEL ROAD
CRETE, ILLINOIS 60417

September 30, 1970

Dear Mr. Klassen;

Hopefully you will support Open Lands and all the environmental organizations which oppose the discharge of heated water into Lake Michigan and propose a standard of discharge no higher than 1 degree at the point of emmission of heated water.

The effects of heated water are not known at this time. We can no longer afford to pursue traditional practices which have accounted for the cesspool conditions affecting our inland waters.

Thank-you for your attention.

Very truly yours,

Nancy McCrohon

RECEIVED
OCT 5 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

SEP 30 1970
ENVIRONMENTAL PROTECTION AGENCY
STATE OF ILLINOIS

F. SCAMMON BARRY, M. D.
1761 RIVER DRIVE
GLENVIEW, ILLINOIS
GL 4-5353

Sept. 27
1970

Clarence Klassen, Ill. Environement
Protection Agency
535 W. Hefferson St.
Springfield, Ill. 62706

Dear Mr. Klassen: I urge you to use all of your influence to get the 4-state Enforcement Conference on Pollution of Lake Michigan to adopt the strictest standard under consideration for thermal pollution. I believe this is the standard announced by the Dept. of the Interior.

This opinion states: "the minimum possible waste heat shall be added to the waters of Lake Michigan. In no event will heat discharges be permitted to exceed a 1 degree rise over ambient at the point of discharge."

Thank you for your attention.

Yours truly,

F. Scammon Barry

NINETY-FIRST CONGRESS

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U.S. House of Representatives
Committee on
Merchant Marine and Fisheries
Room 1334, Longworth House Office Building
Washington, D.C. 20515

ROBERT J. ABLES
CHIEF COUNSEL

ROBERT J. MCELROY
CHIEF CLERK

October 12, 1970

Honorable Walter J. Hickel
Secretary
Department of the Interior
Washington, D. C.

Dear Mr. Secretary:

I wish to bring to the attention of your agency certain matters with regard to the Four State Lake Michigan Enforcement Conference dealing particularly with waste heat emissions into Lake Michigan.

It is my wish that this communication be included in that record and that it be carefully considered by you in connection with actions to be taken on heat emissions into Lake Michigan.

I would call to your attention your responsibilities under Public Law 660, as amended, dealing with different forms of pollution, including heat emissions. In addition to this, I would very forcefully direct your attention to the Environmental Policy Act of 1969 which imposes upon you the duty to interpret your fundamental statutory and regulatory authority and responsibilities so as to assure a clean, wholesome and desirable environment.

Your agency is even required under Section 103 of the Environmental Policy Act to submit statements as to how you propose to bring your regulatory and statutory authority into conformity therewith, and upon failure to be able so to do, to report to the Congress advising this body of how your statutory powers, duties and authorities should be changed to come into conformity with the policy statement of the Environmental Policy Act.

Pollution of the Great Lakes system is a major aesthetic, conservation, environment and resource problem. Lake Michigan is perhaps the most endangered of all the Great Lakes because of the low level of flow into that Lake and the long time that pollutants of different kinds remain there before being carried out by flow of water. Massive heat emissions of the kind contemplated by the chain of thermonuclear and conventional generating plants around its shores not only will be a major source of pollution, but will constitute forces bringing about significant changes in the ecology and environment of the Lake. In addition to this, massive heat emissions will increase the effect and hazard of other pollutants dumped into the Lake by industry and cities.

It is my understanding that most of the operators and those associated with the nuclear and conventional generating plants which have appeared before your agency have given you to understand that the choice is between heat pollution and no plant.

I wish to bring to your attention that this is not the choice, but that there are a number of alternative methods whereby the emission of heat into the Lake may be reduced or avoided altogether. Cooling towers, settling ponds, holding basins and dilution of the water by pumping of extremely cold waters from the depths of the Lake are all available to the users in addition to a number of other technologically and economically feasible devices.

I specifically call to your attention the fact that the National Science Foundation has made a significant grant to Scripts Marine Laboratory in California to study pumping of water from extremely deep levels to be used both for cooling and dilution of cooling returns so as to restore the water to temperature approximating that of the surface levels of the recipient water body.

I wish you to know of my strong feelings on this matter, and I sign this letter as Chairman of the Subcommittee having jurisdiction over the Environmental Policy Act, which I would have you know imposes a far higher level of responsibility on you than many of the witnesses appearing before you have had you believe.

Sincerely,

John D. Dingell, Chairman
Subcommittee on Fisheries
and Wildlife Conservation

E

Oct. 13, 1970

Mr. Murray Stein,
Federal Water Quality Administration
Department of the Interior,
Washington, D.C.

Dear Mr. Stein:

On the last day of the Lake Michigan Enforcement Conference (October 2, 1970), mention was made of the fact that additional statements would be accepted for the records, if mailed to you during the following three or four weeks.

There is so much I would like to say in this regard - much of it already said by other excellent speakers that day - and yet I would like to add my part to all the opinions expressed. I thought it could probably be best said by a letter I recently wrote to Mr. Donald C. Cook of the American Electric Power Company, for whom the Nuclear Plant at Bridgman, Michigan has been named. And so - am enclosing a copy of the letter, together with the enclosures I sent to him - all of which are relevant to this matter.

Please consider these copies as my statement.

Thanking you for this opportunity to help in the matter of trying to save Lake Michigan for future generations!

Sincerely,

Voita

MRS. J. F. VOITA
229 North Taylor Ave.
Oak Park, Illinois 60302

Copy to - Dr. Glenn Seaborg
Mr. Donald C. Cook, Pres.
American Power Company
Mr. Myron Cherry, lawyer for
conservation groups

July 8, 1970

Reproduced from best available copy.

Dr. Sam Jensch,
c/o Atomic Safety and Licensing Board,
U. S. Atomic Energy Commission,
Washington, D. C.

Dear Dr. Jensch:

I was in attendance all three days of the hearing in regard to the Palisades Atomic Energy Plant - held in Kalamazoo recently. Had only planned on attending the sessions the first day, but found them so fascinating that it was impossible to stay away.

What I wanted you to know was that I was delighted with the way you conducted the meeting - your open-mindedness throughout - and your fairness in what I felt was the right conclusion of the meeting. For, surely, as you said, there were matters that needed further consideration before the permit could be issued. We seem to be at a turning point in the history of atomic energy, when we need to give more consideration to the total impact on the environment, which is so important for the future of our country. Surely we need electricity and nuclear plants seem to be the answer, but there are ways that our air and water can be protected and we need to emphasize this to the fullest in developing this new means of "power".

I have a cousin - a lawyer - Victor [illegible] Schmidt - who is connected with the Atomic Energy Commission office in Washington, D.C. Recently he sent me copy of a talk given by Dr. Seaborg at a joint conference of the Chemical Institute of Canada and the American Chemical Society at Toronto, Canada on May 25th, 1970. In reading over this talk I came to the conclusion that Dr. Seaborg, himself, is taking a second look at some of the problems of nuclear power. I will quote a few sentences from his talk, as follows:

> "There are signs that our environmental crises are beginning to force us to a more rational use of energy. One aspect of this has been the increasing interest in the proper siting of power plants in the U.S. I believe we are bound to see in the near future an approach to the regional, national and perhaps international planning of power plant siting that will consider several factors. These will include environmental effects such as thermal effects on water systems, air pollution problems as determined by regional atmospheric conditions and population densities, the management of radioactive effluents, the need for better management of land and wildlife and recreational resources, aesthetic considerations and many other factors that are not now central considerations in the siting of power plants, not to mention the planning of more imaginative energy systems . . . . . Local thermal effects are a much greater problem and are already noticeable. We will have to disperse the heat produced more carefully. Certainly if we are going to use our energy to continue to benefit man and not harm him or his environment, we will have to give far greater consideration to the management of what is now our waste heat. I believe this can be done by better site planning, and with the proper use of new and existing cooling technologies, such as cooling towers - of both the wet and dry variety - holding ponds, canals, and other methods."

So - I feel you are doing a real service in seeing to it that due consideration is given to the survival of Lake Michigan, before issuing a permit to the Palisades Plant to operate. We have a summer home at Bridgman, Michigan - just a mile south of the Donald C. Cook Nuclear Plant now under construction. We feel that what your Board decides will apply equally to this new plant - and feel also that it is only fair to the power companies that standards are set before their building operations are completed - and so we will be greatly interested in what takes place when the hearing is resumed on July 21st. I hope to be present - and want to thank you personally for your efforts in this matter, and for your competence in handling this most difficult and complex situation.

Sincerely,

Alma T. Voita

Copies to - Secretary Resor
Senator Edward Muskie
Senator Philip Hart
Secretary Walter J. Hickel
Donald C. Cook

Dr. Francis T. Mayo
Gov. Wm. G. Milliken
Michigan Dept. of Natural Resources
Carl L. Klein
Dr. Glenn Seaborg

July 9, 1970

Col. James T. White, Jr.
Army Corps of Engineers,
P. O. Box 1027
Detroit, Mich. 48231

Dear Col. White:

Last week my husband and I visited the new completed Information and Visitors' Center at the Donald C. Cook Nuclear Plant, Bridgman, Michigan. There I learned you have not yet granted the permits for the proposed temporary harbor, or for the installation of the pipes for the "cooling system". You can believe I was very thankful to learn this fact.

Recently I have attended several hearings which have been most interesting, and which I believe represent a turning point in the environmental protection story, which will influence what is to be done in the future to stop pollution in all its forms.

First - the Lake Michigan Enforcement Conference, held in Chicago on May 7th, established the fact that the Department of the Interior thought it advisable to set a new standard in regard to thermal pollution, as follows: "The minimum possible waste heat shall be added to the waters of Lake Michigan. In no event will heat discharges be permitted to exceed 1 degree F. over ambient at the point of discharge. This will preclude the need for mixing zones." I understand that the four states bordering on Lake Michigan are now considering this new standard, to put it on a working basis.

Second - the meeting held in Kalamazoo, Michigan on June 23, 24 and 25, in which the Atomic Energy Commission conducted a hearing in regard to granting a provisional operating license to the Consumers Power Company for the opening of its now completed Palisades Nuclear Plant. Four environmental groups, joined by the Sierra Club, together with several lawyers who gave their services without pay, brought in enough evidence that Mr. Sam Jensch of the Atomic Safety and Licensing Board adjourned the meeting after three days of testimony, since he became convinced there were too many issues to be resolved, requiring further information on all types of possible pollution connected with the operation of the plant. Therefore he called for a recess, without issuing any permit, asking that further data be presented by all parties involved - the hearing then to be reconvened on July 21st. The deciding factor in all this, it seemed to me, was the fact that since April 1, 1970 Congress has passed into federal law new environmental protection and water quality acts, which make any thermal or radioactive pollution illegal.

The objective of the conservation groups is to see to it that the Palisades Plant is forced to install a closed circuit cooling system and a zero emission xxx radioactive waste control system. Whatever the final outcome of this Atomic Energy Commission hearing is, it will also be pertinent to the Donald C. Cook Plant, and we want to be sure that the necessary changes in their plans are considered now!

Just this morning in the news report, we learned that President Nixon has organized a new Federal Environmental Protection Agency, that will have complete charge of all matters pertaining to the protection of the environment. With all these new agencies and laws being set up, it seems to us that the Army Corps of Engineers should not grant any permits to the Donald C. Cook Plant at the present time, awaiting the new standards that will inevitably be set to govern the development of nuclear energy. You surely would be doing the Indiana and Michigan Electric Company a real service by delaying the granting of these permits, so that they will make no costly mistakes that will later have to be rectified.

We do hope you will add the Army Corps of Engineers to the list of organizations who are now actively concerned in all forms of pollution - and assure you we will greatly appreciate your efforts in this regard.

Sincerely, Alma T. Voita

Copies to - Senator Philip A. Hart
Michigan Water Resources Commission
Mr. Donald C. Cook, Pres. Am. Power Co.
Col. James T. White, Army Corps

July 9, 1970

Gov. Wm. G. Milliken,
State of Michigan, Lansing, Mich. 48926

Dear Gov. Milliken:

May I preface my remarks by saying that for the past thirty-three years we have been spending our summers in Michigan - and have come to feel that it ranks above most any state in the union for sheer beauty and enjoyable features. We have adopted it as our favorite place to be - and in the very near future hope to make it our permanent home. Needless to say, it is the big lake itself that is the most appealing aspect of our love for Michigan and we are very much disturbed by what has been going on in recent months to undermine this most salient and important natural resource.

Just two weeks ago I attended a three day hearing at Kalamazoo, in which the Consumers Power Company was seeking a license to operate its now completed Palisades Nuclear Plant. It was a most interesting and surprising meeting in the fact that the Atomic Energy Commission completely reversed its thoughts that it was not concerned with the thermal pollution that would result in the heated water to be introduced into the Lake at 28 degrees F. As you are aware, I am sure, the meeting was adjourned, without the granting of the permit, in order that more evidence and factual material be produced by all parties concerned - to be reconvened on July 21st. There is no way to predict what the outcome will be - but at least we conservationists feel there is hope!

Now - what I am most concerned about is that during this meeting the fact was constantly brought out that the state of Michigan has set no standards in regard to Lake Michigan. Your attorney general (or it might have been someone who represented him) gave evidence to this fact and could promise nothing in the way of future regulations. This is hard to believe in the face of the fact of how important the Lake is to the entire state in ways that would take pages to enumerate. We cannot understand the reason for this - and do hope that in the near future steps will be taken to correct the matter - which is the reason I am calling it to your attention.

I am sure you are aware of the importance of this matter, when the Department of the Interior proposed a limit of no more than one degree rise at the outfall of each plant. As I understand it, this proposal must be acted upon by a conference of the four states involved. May we say, we are hopeful that the state of Michigan will fulfill its obligation in this matter, setting a state standard as nearly in accordance with this proposal as is practically possible. If this happens, our confidence in the leadership of this glorious state will be renewed and intensified.

May I suggest that before you and your colleagues come to any definite conclusion that you look carefully into the regulations set forth in two acts passed by Congress since April 1, 1970 - both the National Environmental Policy and the Water Quality Act. It was facts brought out in regard to these two recent Congressional acts that caused the Atomic Energy Commission Licensing Board to look further into the matters involved and to continue the above mentioned hearing at a later date.

The Palisades Plant was designed and built, meeting the standards (or lack of standards) - and now it is ready to begin operations - and so far cannot obtain the license to do so. It surely is not fair to the Consumers Power Company or to the Indiana & Michigan Power Company to plan their facilities under conditions like this. Our summer home is just a mile south of the Donald C. Cook Nuclear Plant under construction. They at the present time are endeavoring to get a permit to introduce heated water into the Lake at 21 degrees F., and as far as I know the Army Corps of Engineers have not as yet issued the license. What must be hold it up is the uncertainty as to the laws of the state of Michigan.

We will greatly appreciate your efforts to rectify this situation, keeping in mind that nothing should be permitted that would in any way cause the deterioration of Lake Michigan.

Sincerely,

July 14, 1970

Mr. Donald C. Cook, President,
American Electric Power Company, Inc.,
2 Broadway, New York, N.Y. 10004

Dear Mr. Cook:

It has been some time since we have been in communication. So much has happened in just the past few weeks - and there is so much to talk about, I hardly know where to begin. Since you have been kind enough to give attention to my previous letters to you, I am again taking the opportunity to talk with you about recent developments.

First, I would like to tell you about the pleasure we had on a recent Friday evening of being guests of the Indiana and Michigan Power Company at your recently opened Cook Nuclear Center. Mr. Druckemiller sent all of us in the area a letter of invitation and many took advantage of the opportunity to learn what is being done and of the progress that has been made. The Center surely is an architectural gem and the landscaping is beautiful and so appropriate to the area. We spent an enjoyable hour at the Center and Mr. Druckemiller was the perfect host. We have become friends and it is always a pleasure to talk with him, to which he agrees, even though we do not always find ourselves in accord.

I have attended several meetings during the past two months, each of which has relevance to the Donald C. Cook Plant at Bridgman. I feel sure you have known of them - (1) a 4-State Lake Michigan Conference, held at Zion, Illinois, sponsored by the Open Lands Project, (2) the Executive Session of the Lake Michigan Enforcement Conference, held in Chicago on May 7th, and (3) - and probably the most important - a three day hearing under the auspices of the Atomic Energy Commission at Kalamazoo, Michigan, in regard to the Consumers Power Company Nuclear Plant at Palisades Park, Michigan.

Two most unexpected developments have come out of these meetings -

(1) The proposal that "in no event will heat discharges be permitted to exceed 1 degree F. rise over ambient at the point of discharge, thus precluding the need for mixing zones", - this being proposed by the Department of the Interior. As I understand it, the four states bordering on Lake Michigan are now in the process of evaluating this proposal in the hope of arriving at a workable solution, in determining just what the safe, permissable temperature should be for water returned to the Lake. This will in all probability take at least six to nine months to accomplish. So - we will have to wait to see what comes of it!

(2) The meeting at Kalamazoo, conducted by a Board of the Atomic Energy Commission, in regard to the granting of a license to operate to the Consumers Power Company for its now completed plant at Palisades - produced a most unexpected result - a complete reversal of a stand the Atomic Energy Commission has taken in the past. As was stated by the Board repeatedly at the opening of the meeting, it was not concerned with the problem of "thermal pollution" - but at the end of three days a recess was called so that further evidence could be brought in by all parties concerned. I am enclosing a newspaper report which covers the three day hearing quite adequately, but wish to say further, that the lawyer who gave his services without charge, presented his case for the conservation groups in a brilliant manner, leaving no doubt that the recently passed Congressional Acts (both the Environmental Act and the Water Quality Act) require a complete review of standards that have been felt adequate in the past. And so, as stated above, the hearing was recessed after three days, to be reconvened on July 21st. I hope to be present at that time.

With the above in mind, you can imagine how surprised and disappointed we all were to learn that the Army Corps of Engineers just within the past week has granted the two permits which were being contested by many groups and individuals in this area - in the face of the fact that so much is developing along this line just at this time. It seems to me this is most short-sighted at a time when new standards are in the process of being set - and before all the evidence is in. For, surely, what happens at the meeting in Kalamazoo next week will apply to the Donald C. Cook Plant as well.

As I am sure you are aware, President Nixon is at present setting up a new Environmental Protection Agency, drawing the major elements of pollution fighting agencies under one umbrella, for a concerted battle to clean up the nation's air and water. Surely this new agency will be above the Army Corps, if it is to be effective at all, and at last the long history of horrible instances of environmental deterioration, which has rightfully been placed at the doorstep of the Corps, will be brought to an end.

I am asking that you give consideration to the copies of letters I have written to various concerned people - especially to the letter to Mr. Sam Jensch, in which I have quoted from a recent speech by Dr. Glenn Seaborg, which brings out the fact that he too is becoming aware that new standards have to be set, as applied to atomic energy, to protect the environment.

Then - there is the article about new plans to use the hot water waste of Nuclear Plants - a study being conducted at the Oak Ridge National Laboratory - which show that new and constructive ways are being envisioned for the use of what is now "waste heat".

I know you do feel that there will be no harm to the Lake by adding heated water. But from all the evidence I have heard, there is much feeling and knowledge to the contrary. The Open Lands Project (entirely funded by concerned business men and individual citizens) began in a small way, being interested in preserving the environment in the Chicago area, and now, just within the last few weeks, extending their activities and concerns to the entire Lake Michigan area, including all four states bordering on its shores, so that with this larger organization they can become more effective in their efforts. They are very much concerned with the thermal pollution and are putting all their efforts and scientific knowledge to work to stop it.

As you might remember, we have spent over thirty summers on the Lake in this area (just a mile south of the Cook Plant) and I have seen the Lake constantly deteriorate. We now have algae most of the time - something that was unknown a few years ago - all due to the misuse of the Lake by industries and municipalities over a long period of time. So, the adding of "heated water" is a real danger, especially as it is added to the pollution that already is present in Lake Michigan. Dr. Ayres himself admitted at the open hearing in Bridgman this spring that there would be algae in the immediate vicinity of the Plant and when pressed for an answer as to how far, he said it would probably cover a mile or two each way. This is terrifying to us who are within that vicinity, but also for many others who come to the beaches for relaxation and recreation. In the past two summers we have had days when the algae was so severe we had to stay away from the Lake until the condition improved. With the addition of "heat", this condition cannot help but become more intolerable.

Senator Hart in a recent letter to us stated as follows: "It is my fear, as I am sure it is yours, that we will go on planning only one power plant at a time on Lake Michigan, building in cooling facilities that account for the effect of the effluent of only that one plant. We are told there may eventually be 100 plants on Lake Michigan. Thus it is imperative that maximum precautions be taken now if we are to maintain the fish and aesthetics of the Lake in the future." Are we, in the Bridgman area, to be the unfortunate ones who suffer from this fact? Do you feel it is fair to allow the Donald C. Cook Plant to operate under these precarious and greatly contested circumstances when future plants will have to meet other, more stringent standards?

I think what I am trying to lead up to is an idea that I have had for some time now - that you, in your capacity as President of the American Power Company, are the one person, and the only one who can change all this. For it is in your power to decide that the Army Corps of Engineers has acted hastily and without wisdom - and that you will not therefore take advantage of this decision, although it is the easy way out. What a myriad of friends you would make if one morning we would read in the paper - "Donald C. Cook, president of American Power Company, has made the decision to al- the plans for the Nuclear Plant being named after him, so that hot water ission into the Lake will be stopped and other plans adopted for cooling purposes, thus assuring those who have been concerned - that the Donald C. Cook Plant will not contribute to the possible contamination of Lake Michigan forever."

Feeling this as deeply as I do, I have put off writing this letter since it has seemed to me a hopeless task to put into words the ideas I feel might help you to make this decision, wishing I could "talk it" instead of "writing it".

One thing I have wished is that you could review what was said at the Kalamazoo meeting, especially the arguments used by Mr. Cherry, the lawyer who was responsible for the AEC decision to re-think all that is involved, before granting the permit which was so greatly desired by Consumers Power. I know there is a copy of the proceedings of the entire three days at the City Hall in Kalamazoo, and wonder if there might be a way you could obtain a transcript of it.

Although I feel and know you have given serious and conscientious thought to all that has gone into the planning of the Cook Nuclear Plant, I am hoping desperately that somehow I can persuade you to think just this one step further - that with all that has been happening in the past few weeks - all the recent findings and revised theories that has been of concern in high places, from President Nixon on down through the various bureaus and commissions in the government - you will proceed more slowly and with more thought in all that is being planned for the Donald C. Cook Plant.

I do hope that some time we might meet. As I told you in a previous letter, I had the pleasure of meeting several of your key men from the New York area, when they were present at the public hearing at Bridgman this spring - and so am hoping that in some future visit in our area, it might be my privilege to meet and talk with you. You are cordially invited to be a guest in our home in Dunewood, on the Lake, at Bridgman, at any time you could honor us with your presence.

Daring to hope for a reply from you, whether it be favorable or not - but most of all - daring to hope that we, the concerned people of the area, together with you, can somehow in our mutual efforts, devise some means to assure the saving of our glorious Lake for the generations to come -

I am, most sincerely,

Alma F. Voita

Mrs. J. F. Voita,
229 N. Taylor Avenue,
Oak Park, Illinois 60302

Summer address -
Dunewood, Bridgman, Michigan 49106

An article from "The National Enquirer"

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NEW PLAN WILL USE HOT WATER WASTE OF NUCLEAR PLANTS TO HEAT AND COOL CITIES

- - - - - - -

Instead of polluting lakes and streams and killing fish by the thousands as it does today, the hot water expelled from nuclear power plants could be of vast benefit to mankind, a noted atomic scientist says.

It could be used to heat and cool entire cities, maintain huge greenhouses for food crops, and even help solve other pollution problems such as waste disposal.

This is the picture painted by Samuel E. Beall, head of the Nuclear Reactor Division at Oak Ridge National Laboratory in Oak Ridge, Tenn. Beall says much of the energy generated by atomic reactors is lost in the water used for cooling them. By utilizing this wasted power, he told The Enquirer, industry could turn a potential environmental disaster into a blessing.

With this in mind, he noted, a new division of Ecological Sciences has been set up at the Oak Ridge National Laboratory to search for ways to turn the liabilities of nuclear energy into assets. "A large city could be heated and cooled with the throw-away heat from nuclear plants, and it could be done more cheaply than with electricity", Beall said. He explained that the hot water could be piped into the city and used to operate heating and refrigeration equipment.

The hot water could also be used to heat giant greenhouses, thus creating additional food supplies to feed entire cities, Beall suggested. "With a constant flow of hot water, temperatures and humidities could be regulated in greenhouses to greatly increase the productivity of existing acreage. By using the land all year round for three separate crops, one acre of land under such a greenhouse could produce up to 600,000 lbs. of tomatoes, for example - or 10 times as much as an average outdoor acre."

The otherwise wasted heat from nuclear reactors could also be used to evaporate waste water in sewers, Beall said. Then the purified water produced by the evaporation could be recycled into water treatment plants for human consumption - without costly purification procedures.

A team of 50 scientists, headed by Dr. Stanley Auerbach, will work in the new Ecological Sciences Division at the Oak Ridge National Laboratory. Their findings will be used in planning all types of industries in order to provide maximum benefits with a minimum of environmental pollution.

United States Steel Corporation
525 William Penn Place
Pittsburgh, Pa. 15230

H J DUNSMORE
DIRECTOR ENVIRONMENTAL CONTROL

October 26, 1970

Mr. Murray Stein
Conference Chairman
Federal Water Pollution
Control Administration
Washington, D. C. 20242

Dear Mr. Stein:

Third Session - Federal Conference
on Lake Michigan and its Tributary Basin

United States Steel Corporation wishes to have the following statement included in the official record of the Workshops on Lake Michigan held in Chicago, Illinois, on September 28 - October 2, 1970:

Three plants of United States Steel Corporation, namely, South Works, Gary and Waukegan Works, are located on the shores of Lake Michigan and would be directly affected by standards limiting temperature in the waste water discharges from these plants.

Although the temperature and volume of these discharges are substantially lower than those of the power industry, a requirement of recirculation or other closed system method to control heat would present substantial problems to United States Steel Corporation as well as, we expect, to all other industry.

The general tenor of the scientific testimony at the Conference indicated the lack of substantial knowledge of the present and future effects of thermal discharges to Lake Michigan, but that significant study programs on the question are in progress. In light of this we recommend maintaining the existing standards until such time as these studies and others demonstrate the nature and extent of needed change, if any.

Very truly yours,

HJD:ujw

AMERICAN ELECTRIC POWER *Service Corporation*

AEP

2 Broadway, New York, N. Y. 10004
(212) 422-4800

October 27, 1970

To The Conferees
The Lake Michigan Enforcement Conference

Mr. Murray Stein, Chairman
Mr. David Currie
Mr. Thomas Frangos
Dr. F. T. Mayo
Mr. Perry Miller
Mr. Ralph Purdy

Gentlemen:

At the Workshop Session of the Lake Michigan Enforcement Conference on September 28 - October 2, there was some discussion of the thermal bar. The "White Paper", Physical and Ecological Effects of Waste Heat on Lake Michigan, based much of its argument on the occurrence of substantial, long-period build-up of temperature and of chemical concentrations behind a barrier at the "thermal bar" that prevented mixing. Attached is a discussion of this concept prepared by Dr. John C. Ayers.

Very truly yours,

T.A. Miskimen

T. A. Miskimen

TAM/fkr
(attachment)

Comments on the Thermal Bar as a Barrier to Mixing

John C. Ayers

The concept that the thermal bar is a real physical barrier to horizontal transport and mixing appears to have had its origin in misinterpretation or in misapplication of the conclusions in the papers of Rodgers (1965, 1966, 1968). As I read these background papers I find Rodgers to be writing very cautiously; the strongest statement that I find in these papers is in his 1966 paper where he says on p. 371: "In the case of Lake Ontario there appears to be some validity to the concept of the thermal bar as a barrier." It should be noted that the wording is: 'appears to be some validity'; this is no statement that the thermal bar _is_ a barrier.

The first bald statement that the thermal bar _is_ a barrier to horizontal mixing and transport is in the publication "Lake Currents" (Lake Michigan Basin) by the FWPCA, Great Lakes Region, Chicago, Illinois, November 1967. In this publication there is a strange drift from a sensible discussion of the annual temperature regime of Lake Michigan on pages 19 through 21 (in which it is pointed out that in spring the thermal bar as described by Rodgers _may_ develop), to a firm conclusion on p. 353 which says: "Thermal barrier conditions during the fall, winter, and spring period limit the outward extent of the effective mixing volume. This factor appears to be responsible for unusual solids build-up in the nearshore waters during this period."

It appears that the latter conclusion has been picked up by the USBCF in the preparation of their "White Paper" and that it has been the basis for their definition of an inshore zone that does not mix with the rest of the lake.

In view of the FWPCA's conclusion that unusual solids build-ups occur in the nearshore waters in fall, winter, and spring, it is proper to test their hypothesis by examining available independent data for evidence of unusual solids build-ups. The suitable long-term data available are those of the water-treatment plants on the perimeter of Lake Michigan. These plants draw their water from the very same nearshore waters in which FWPCA found or postulated unusual solids build-ups. If the thermal barrier conditions in fall, winter, and spring do limit outward mixing, the records of the water-treatment plants should show higher levels of "solids" in those seasons. Indeed, if the thermal barrier condition is continuous throughout the fall, winter, and spring seasons (as the FWPCA implies) the record of "solids" in the nearshore waters should begin to rise in fall, continue to rise in winter, and reach a maximum sometime in spring before "spring storms destroy the thermal bar."

I have examined the available records of longer-term conservative (not influenced by biological activity) "solids" at Michigan City, Indiana; at Gary, Indiana; at Milwaukee, Wisconsin. The results are presented as annual graphs of the available "solids" parameters in Figures 1 through 4.

Figure 1 presents the results of samplings by the State of Indiana for specific conductivity at the Michigan City water plant for the years 1957-1967 inclusive. There is a small rise in specific conductivity in the months March through May which may or may not be significant, but certainly there is no substantial rise in this "solid" beginning in fall, continuing through the winter, and culminating in a maximum in spring.

Figure 2 gives the levels of chlorides (as chlorine) in the Michigan City intake records for the years 1957-1967 inclusive. The graph shows no difference in chlorine in the nearshore water from year's beginning to year's end. That the contribution of chlorine from the early-spring melt-off of road salt is not detected by the local water plant indicates that there was substantial escapage to the open lake and that the spring thermal bar at Michigan City was not operating as a collector of pollutants.

Figure 3 shows the annual distribution of total dissolved solids at Gary, Indiana, for the period October 1959-September 1962 inclusive. Levels of TDS in January, February, and March are slightly higher than for the rest of the year, but there is no evidence of a rise beginning in the fall, continuing through the winter, and culminating in a maximum in spring.

Figure 4 depicts the year-round condition of total dissolved solids at the Milwaukee, Wisconsin, water plant from August 1960 through September 1962. Here the data show no change from year's beginning to year's end. There is no evidence of a collection of "solids" behind a thermal barrier in any part of the year.

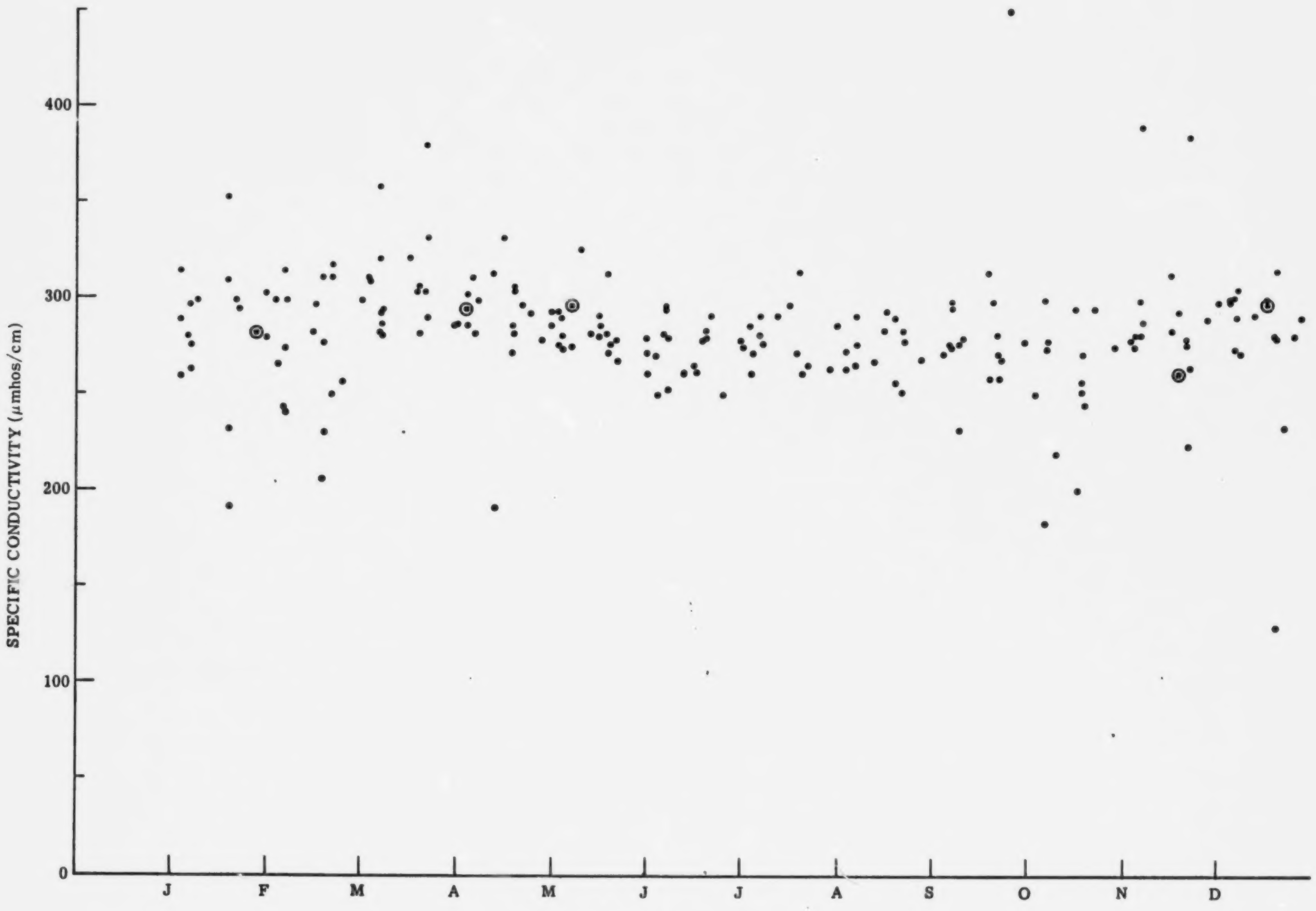
In summary, the independent data available with which to test the FWPCA hypothesis that thermal barrier conditions in fall, winter, and spring collect unusual levels of "solids", do not support the FWPCA hypothesis.

References

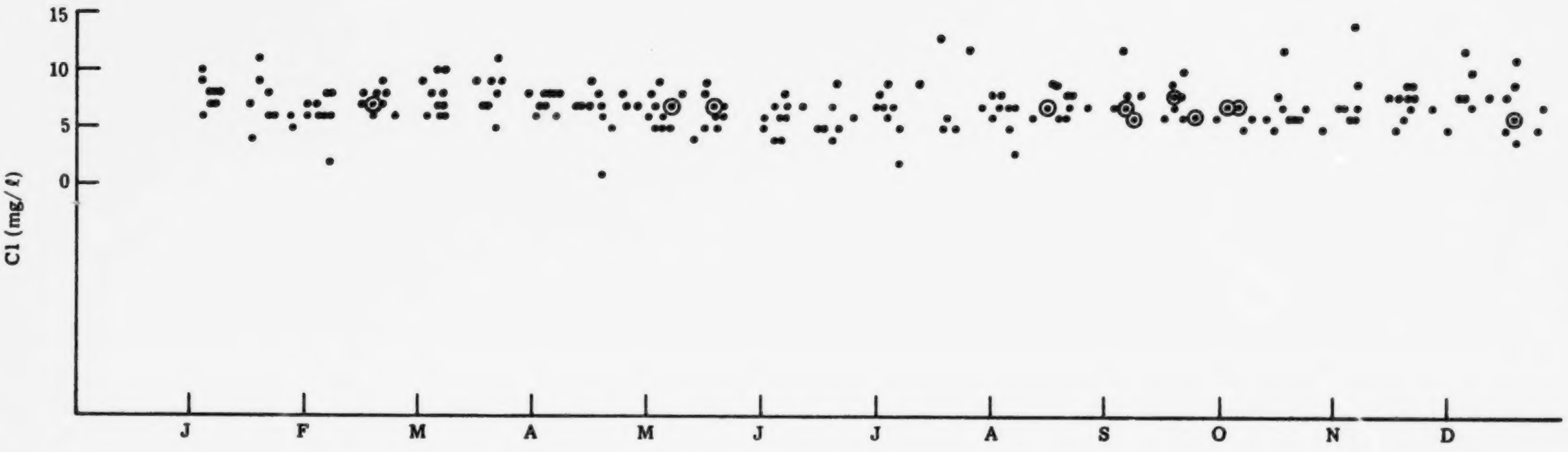
Rodgers, G. K. 1965. The thermal bar in the Laurentian Great Lakes. pp. 358-363 *in* Proc. 8th Conf. on Great Lakes Research. Univ. of Michigan, Ann Arbor.

Rodgers, G. K. 1966. The thermal bar in Lake Ontario, spring 1965 and winter 1965-66. pp. 369-374 *in* Proc. 9th Conf. on Great Lakes Research. Univ. of Michigan, Ann Arbor.

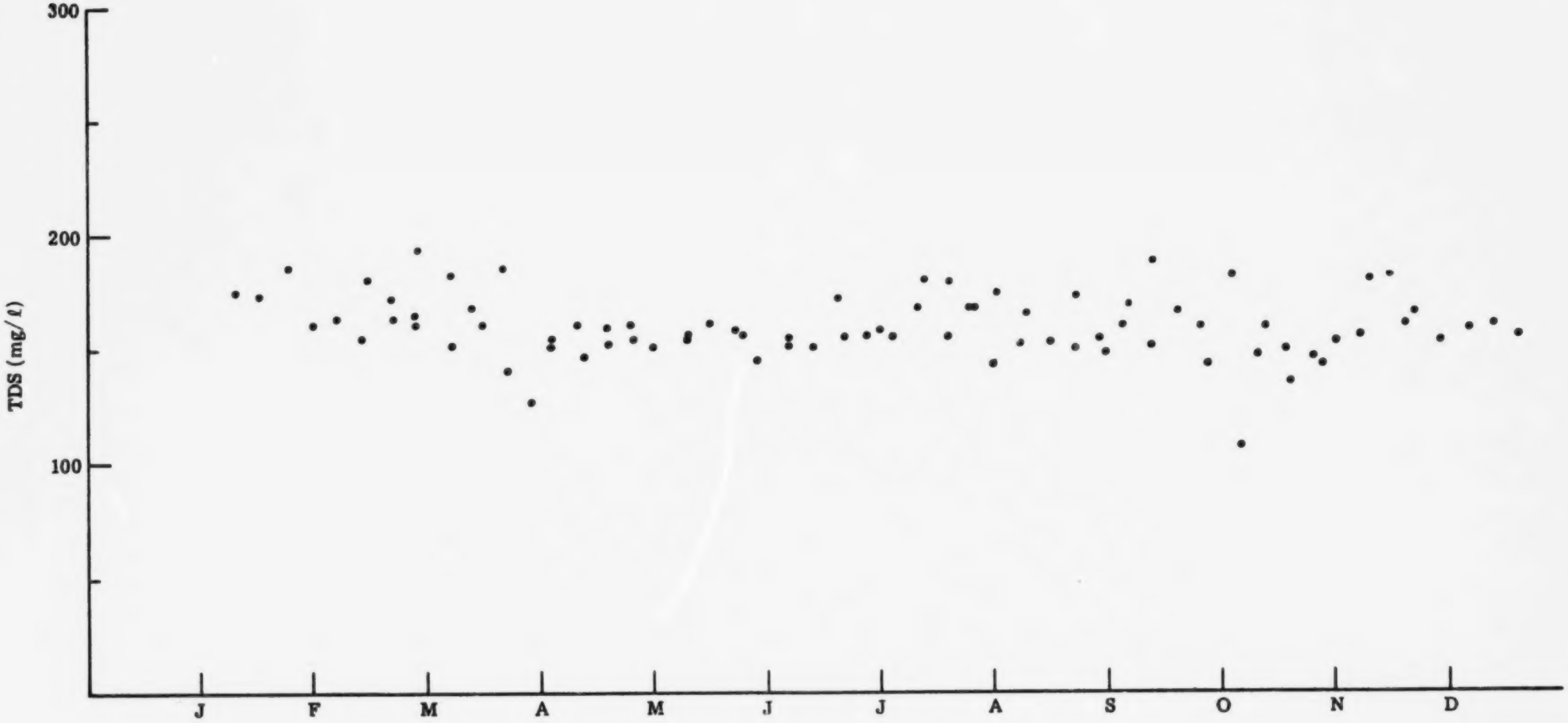
Rodgers, G. K. 1968. Heat advection within Lake Ontario in spring and surface water transparency associated with the thermal bar. pp. 480-486 *in* Proc. 11th Conf. on Great Lakes Research. Internat. Assoc. Great Lakes Res. Ann Arbor, Michigan.



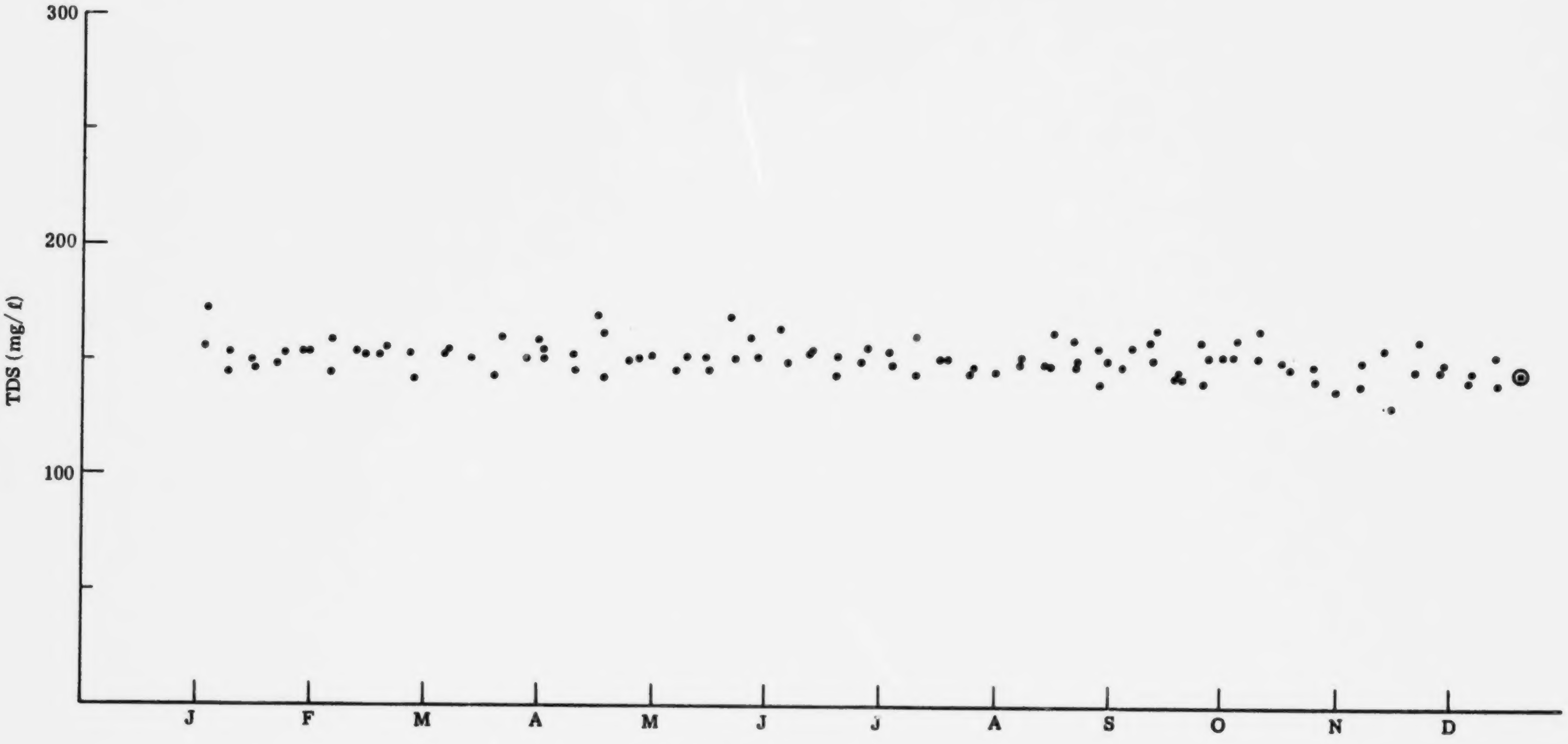
MICHIGAN CITY, INDIANA
SPECIFIC CONDUCTIVITY, 1957—1967 INCLUSIVE



MICHIGAN CITY, INDIANA
CHLORIDES AS Cl, 1957 — 1967 INCLUSIVE



GARY, INDIANA
TOTAL DISSOLVED SOLIDS
OCTOBER 1959—SEPTEMBER 1962



MILWAUKEE, WISCONSIN
TOTAL DISSOLVED SOLIDS
AUGUST 1960—SEPTEMBER 1962

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

L. P. Voigt
Secretary

BOX 450
MADISON, WISCONSIN 53701

November 4, 1970

Mr. Murray Stein
Assistant Commissioner for Enforcement
Federal Water Quality Administration
Department of the Interior
Washington, D. C. 20242

Dear Murray:

Attached is a copy of a statement from Senator Proxmire which he wishes to have entered into the record of the Thermal Pollution Workshop of the Lake Michigan Enforcement Conference.

Could you take care of this, please?

Very truly yours,

D. J. Mackie
Assistant Secretary

DJM:dgb
Attach.

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Congress of the United States
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JAMES W. KNOWLES,
DIRECTOR OF RESEARCH

October 23, 1970

Mr. L. P. Voigt, Secretary
Department of Natural Resources
P.O. Box 450
Madison, Wisconsin 53701

Dear Les:

Enclosed you will find my statement prepared for the record of the Lake Michigan Pollution Conference. The subject of the statement, as you know, is thermal pollution and Lake Michigan.

Thanks so much for your cooperation in this matter.

Warmest regards.

Sincerely,

William Proxmire, U.S.S.

WP:rwb

Statement by Senator William Proxmire

WASTE HEAT AND LAKE MICHIGAN

Waste heat is rapidly becoming one of this nation's most serious sources of water pollution. In order to solve the problems associated with waste heat, we must fully understand its causes, effects and controls.

Tremendous amounts of water are used each year by industries for cooling purposes. In fact, according to the Federal Water Quality Administration (FWQA), almost one-half of all water used in the United States is utilized for cooling and condensing by the power and manufacturing industries. In 1964, this amounted to about 50 trillion gallons.

How Thermal Pollution Can Affect Lake Michigan

The potential for serious ecological damage to our nation's water resources as a result of the discharge of industrial waste heat is readily apparent when we examine Lake Michigan.

Although more research is needed on the ecological effects of waste heat, the evidence gathered to date substantially demonstrates the adverse effects of thermal pollution. Let me describe two of these effects in relation to Lake Michigan.

First, waste heat can speed eutrophication -- the process by which a lake chokes itself to death. The rate of eutrophication is controlled primarily by nutrient supply and water temperature. In Lake Michigan, indications are that nutrients in the inshore waters are approaching levels commonly found in the central basin of Lake Erie. Lake Michigan inshore waters receive a substantial and increasing load of nutrients in the form of nitrogen, phosphorus, and other fertilizing agents from domestic effluents and agricultural run-off. If nutrients are not sufficiently controlled, the inshore waters of Lake Michigan will attain conditions of algae production similar to those in Lake Erie. When these conditions are reached, temperature becomes a very important factor. Blue-green algae, which are especially responsive to higher temperatures, will increase in direct proportion to temperature increases. The process of eutrophication will be well on its way. Lake Michigan will begin to choke itself to death.

Second, evidence gathered to date also demonstrates the adverse effects of thermal pollution on the fish life of the lake. The role of temperature is an important one in the growth, survival and abundance of fish in any water environment. All available information indicates that each fish has specific thermal tolerances. These thermal tolerances vary from life stage to life stage. When the limits are exceeded the organism functions at reduced efficiency and may ultimately die.

As the U.S. Fish and Wildlife Service has pointed out, the timing of natural events is essential for the perpetuation of Lake Michigan coldwater aquatic life. Any waste heat influence which would interfere with this natural timing places the survival of this aquatic life in jeopardy. Evidence indicates that only slightly elevated temperatures may be critical in the life history stages of Lake Michigan species.

Power Needs and Thermal Pollution

Each year this nation's power needs have increased. The public has demanded greater and greater amounts of electric power. And, as a result, power industries have been called on to produce the needed quantities of electricity.

The increasing demands for power over the past decade has meant increasing amounts of waste heat to be disposed of. Thermal pollution has been a direct result, then, of the public's demand for greater amounts of electric power.

In view of the fact that the electric power industry accounts for about 80 percent of all cooling water used in this country, the best single index of thermal pollution potential lies in projecting future power production.

POWER PRODUCTION

The demand for power has increased steadily since the turn of the century. For the past 30 years, power generation has increased at a rate of 7.2 percent annually, virtually doubling every 10 years. This has necessitated a doubling of electric power facilities each decade. This trend is expected to continue, and possibly accelerate, through 2000.

The following table prepared by the FWQA indicates the amounts of electrical power used in certain past years as well as projected national requirements through 1985:

U.S. Electric Power -- Past Use, Future Requirements

Year	Billion KWH
1912	11.6
1960	753
1965	1,060
1970	1,503
1975	2,022
1980	2,754
1985	3,639

Power is usually generated by hydro- or steam-electric plants, with the latter process requiring cooling water for waste heat removal.

There are few sites remaining today for hydro-electric stations, so the power industry must depend more and more on thermal power generation to meet future needs. Presently, thermal plants produce approximately 80 percent of the electricity in the United States. Predictions indicate this figure may reach 92 percent by the year 2000, when two-thirds of the plants may operate on nuclear fuel. Thus, thermal plants will continue to gain a larger portion of a steadily increasing market for power. Waste heat production will increase proportionally, which in turn reflects the increase in waste heat disposal that we must accomodate.

The waste heat output from manufacturing industries, such as the chemical, petroleum and paper industries, will also increase in the coming years. The cooling facility needs of these industries are expected to increase at a 4.5 percent annual rate, compared to the 7.2 percent annual increase expected by the power industry.

Lake Michigan Power Production

As with the rest of the nation, power demands have increased in the Lake Michigan area. In fact, it is predicted that more power facilities will be installed in the Northeast and Midwest in future years than in any other section of the United States. Nowhere are these plans for expansion more apparent than on Lake Michigan. And, as a result, waste heat effluents from the power industries along Lake Michigan will increase.

According to a study recently completed by the Department of Interior, the doubling of power capacity each decade means that the Lake Michigan megawatt capacity will increase at a geometric rate. Cooling water requirements will also increase at a similar rate (almost fourteenfold). Heat addition from steel and municipal sources is expected to increase by 63 percent by the year 2000. In total, it is estimated that waste heat addition to Lake Michigan from these sources will increase from 40 billion Btu's in 1968 to about 431 Btu's in 2000. Thus, at the predicted rate of increase, the amount of waste heat dumped into Lake Michigan by 2000 will be 10 times larger than it is today.

In light of the environmental affects of thermal pollution which I mentioned earlier, it is obvious something must be done to control the massive amounts of waste heat that are predicted for the future.

Waste Heat Limitations

In its first annual report, issued last August, the President's Council on Environmental Quality stated:

> A strong and consistent Federal policy should be developed to control thermal pollution. Criteria should be upgraded to assure prompt and successful negotiations with the States on water quality limits from thermal pollution...

I fully support this recommendation by the Council. It is in the public interest to upgrade water quality standards now.

If we wait too long, correcting the ecological damage caused by thermal pollution may be extremely difficult, if not impossible.

According to the FWQA, the adoption of alternative cooling systems to control heat waste discharges would be economically feasible. The increased costs of the monthly bill associated with adopting alternative cooling systems, based upon an average family electric bill of $9.44 a month, would be:

wet mechanical draft tower	5¢
wet natural draft tower.	9¢
cooling pond	1¢
spray canals	3¢
dry mechanical draft tower	29¢
dry natural draft tower	9¢

Conclusion

Waste heat discharges can be harmful. It is within our power to control these discharges. And it is economically feasible for us to do so. I hope that the federal government, working in cooperation with the states, can act on this without further delay.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1971 O - 422-409 (Vol. 5)